Personal Software

Why Choose PC DOS 7 over MS-DOS 6.22?

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IBM PC DOS Version 7 gives the DOS customer many enhancements in the areas of usability, memory optimization, full-function utilities, and new hardware support, bringing IBM PC DOS to the forefront of the single-tasking operating systems available today. This article compares and contrasts IBM's latest DOS offering, PC DOS 7, with Microsoft's latest DOS offering, MS-DOS 6.22.

Disk Compression

PC DOS Version 7 comes with Stacker 4.0, the industry-standard disk compression software created by Stac Electronics. This technology is integrated into PC DOS 7 to give you the highest compression ratio and the most free disk space possible. Stacker has many features that distinguish it as the leading disk compression software product on the market.

Users of other compression products such as DoubleSpace, DriveSpace, SuperStor/DS, and earlier versions of Stacker can easily and seamlessly upgrade to Stacker 4.0. The version of Stacker bundled in PC DOS 7 provides the convenience of having a complete DOS and Windows interface. Stacker also has the ability to dynamically calculate the current data compression ratio and will automatically reflect the changes to the user. Stacker 4.0, even with the enhanced functionality it
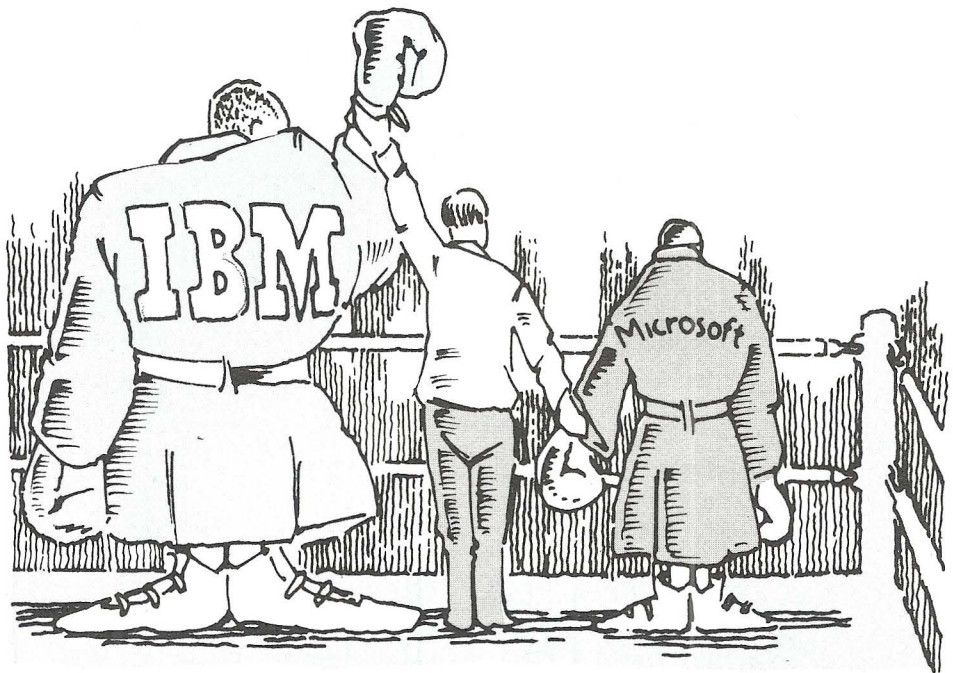
provides, takes up less conventional memory than other disk compression products.

Providing a method for compressed diskette portability has also been solved by the current version of Stacker. With the compression provided by PC DOS 7, you can compress a diskette, take that diskette to any other DOS machine, and be able to access the compressed data on that diskette even though the other machine may not have Stacker installed.

Password protection of drives has also been addressed in a unique manner. Stacker provides the ability to have both Read-Only and Read/Write passwords. This means that a specific compressed drive can be password-protected. You can then give someone else the Read-Only password to access data on the compressed drive, but not to change it. When the computer is turned on, the

user is prompted to enter the Read-Only password, and the drive will be mounted in write-protected mode.

There are many features that distinguish PC DOS 7's data compression offering from MS-DOS 6.22's. Figure 1 gives a brief synopsis of some of the differences.

Backup

Central Point's Backup utility (Figure 2) is included in PC DOS 7. This state-of-the-art backup utility provides a DOS and Windows interface for ease of use. Some features of the latest version of Central Point's Backup are:

- Support for a wide variety of tape formats, including QIC and SCSI interfaces

- Full support for backing up to a hard disk, high-speed diskette, and optical and removable disk drives

	PC DOS 7	MS-DOS 6.22
Compression type	Stacker 4.0	DRVSPACE
Allow for upgrade of other compression products	Superstor/DS, DoubleSpace, DriveSpace, and earlier versions of Stacker	none
Maximum compressed drive size	2 gigabytes	512 megabytes
DOS/Windows interface	DOS and Windows Interface	DOS-only interface
Memory footprint below 1 MB	As small as 17 KB	As small as 36 KB
Ability to tune compression for maximum speed or maximum compression	Included	Not included
Assign password protection to compressed drives	Included	Not included
Dynamically adjust the free space based on actual data compressibility	Included	Not included
Use compressed diskettes on other DOS PCs with or without compression	Included	Not included
Break the 2:1 compression barrier (based on average user data)	Included	Not included
Windows screen saver	Included	Not included

Figure 1. Disk Compression Differences

	PC DOS 7	MS-DOS 6.22
DOS and Windows interface	Included	Included
Compress data while backing up	Included	Included
Backup to floppy diskettes using high-speed floppy access	Included	Not included
Wide variety of tape support	Included	Not included
Schedule backup for execution at a later time when the user is not present	Included	Not included
Support for viewing files from many DOS applications	Included	Not included

Figure 2. Backup Differences

- The ability to be scheduled well in advance for an unattended backup
- The ability to compress data when backing up

Another feature that makes this product easy to use is the inclusion of file viewers, so that you can view many DOS and Windows files prior to backing them up. This enables you to view files such as bitmaps in their native form, so you will readily recognize if they are files that you want to back up or not.

AntiVirus Detection
PC DOS 7's AntiVirus (Figure 3) is one of the best integrated virus-detection software products available. This software protects against over 2100 viruses, while having one of the smallest memory requirements in the industry. It was designed and created by the IBM Research division to be an install-and-forget automatic protection for your PC. It has a component that is active at all times, protecting the system from contamination.

A user can also schedule a periodic check of the entire system for any viruses that may have entered the system. The periodic check can be skipped, or scheduled to occur weekly, monthly, etc. This gives your system maximum configurability and protection without having to overtly take action to maintain a virus-free computer.

IBM AntiVirus has both a DOS and Windows interface for ease of use.

Memory Management
Most DOS users want to maximize the amount of conventional memory available, so one of the objectives when developing PC DOS 7 was to give the user as much memory as possible (Figure 4). This was accomplished by:

1. Tuning the DOS Kernel, utilities, and device drivers to have a smaller memory footprint. Less efficient and more bulky programming routines were replaced by routines that were highly optimized for memory and/or speed. This was all done without losing any features or compatibility.

2. Adding several new features that allow DOS users to move certain pieces of code into upper memory without requiring specialized software. An example is the DOSDATA=UMB command, which (when placed in CONFIG.SYS) moves the FILES, BUFFERS, LASTDRIVE, and STACKS into an upper memory block. This alone can realize a savings of 12 KB in conventional memory.

Most users will gain between 10 KB and 60 KB of memory using IBM PC DOS 7 instead of MS-DOS 6.22, though actual results may vary based on the configuration. Figure 4 shows a gain of 32 KB, and additional savings are possible. For example, if the user uses IBM AntiVirus, the gain can be an additional 17 KB (as shown in Figure 3); and if the user uses compression, the gain can be an additional 19 KB (as shown in

Figure 1). In total, the savings can amount to more than 60 KB.

Online Help

PC DOS 7 includes a highly enhanced online help facility (Figure 5), which offers full-screen online help with pull-down menus and full mouse support. Contained within the help screens are hypertext links that connect to related topics and allow you to see a full description of related commands; when done, you go back to the original screen that you came from.

Part of the online help facility is an online publication viewer. This viewer uses a subset of the information presentation facility (IPF) format, and gives you the ability to view online books. Now you can quickly and easily access many

	PC DOS 7	MS-DOS 6.22
Number of viruses that can be detected	>2100	800
Memory footprint of anti-virus shield	<6 KB	<23 KB
DOS and Windows interface	Included	Included
Advanced fuzzy scanning technology for finding a variety of virus mutations	Included	Not included
Scan OS/2 Boot Manager's boot record for viruses	Included	Not included
Descriptive virus information database, which includes virus symptoms	Included	Not included
Schedule for the automatic scanning of viruses	Included	Not included
Positive verification before anti-virus program attempts to disinfect	Included	Not included
Alert messages can be tailored to tell users which action to perform	Included	Not included

Figure 3. Virus Protection Differences

	PC DOS 7 Conventional / Upper Memory in Bytes		MS-DOS 6.22 Conventional / Upper Memory in Bytes		Conventional Memory Reduction in Bytes
Memory footprint of:					
DOS Kernel	7920 /	0	8720 /	0	800
HIMEM.SYS	720 /	0	1120 /	0	400
EMM386.EXE	3392 /	0	4144 /	0	752
DOS Data Area (Files=30, Buffers=10, Lastdrive=Z, Stacks=9,256)(*)	0 /	12112	12112 /	0	12112
COMMAND.COM	0 /	5568	5760 /	0	5760
ANSI.SYS	0 /	3600	0 /	4208	608
DISPLAY.SYS	0 /	4848	0 /	8304	3456
DOSKEY.COM	0 /	1152	0 /	4144	2992
SHARE.EXE	0 /	2704	0 /	6208	3504
RAMDRIVE.SYS	0 /	432	0 /	1296	864
SMARTDRV.EXE	0 /	28304	0 /	28848	544
NLSFUNC.EXE	0 /	2448	0 /	2784	336
SETVER.EXE	0 /	0 (**)	0 /	464	464
Total Conventional Memory Savings (in bytes): 32592					

* Size of the DOS Data Area can vary by differing the configuration
** All of SETVER.EXE resides in a high memory area, above conventional and upper memory

Figure 4. Memory Management Differences

	PC DOS 7	MS-DOS 6.22
Online reference for DOS commands, utilities, and syntax use	Included	Included
Full-screen online help with pull-down menus and mouse support	Included	Included
Hypertext links connect related topics and show examples of use	Included	Included
Viewer can view other online books using the IPF standard	Included	Not included
Multi-pane viewer displays the table of contents along with the item	Included	Not included

Figure 5. Online Help Differences

	PC DOS 7	MS-DOS 6.22
Ability to navigate the editor with pull-down menus and/or mouse	Included	Included
Edit and view multiple files simultaneously	Included	Not included
Draw lines or boxes using the basic set of ASCII characters	Included	Not included
Sort, add, or multiply data within a marked area	Included	Not included
Extended functions (sorting, adding, paragraph re-flow, set margins, set tabs)	Included	Not included
Undo previously deleted text	Included	Not included
132-column support	Included	Not included
Browse mode	Included	Not included
Provides syntax expansion for the C and REXX programming languages	Included	Not included

Figure 6. Text Editor Differences

	PC DOS 7	MS DOS 6.22
File protection for Tracker and Sentry data recovery schemes	Included	Not included
Full-screen DOS user interface	Included	Not included
File viewers for many DOS applications	Included	Not included
Recovery of files that resided in deleted directories (from a DOS session)	Included	Not included
Advanced undelete method to recover data from destroyed files	Included	Not included
Recovery of files protected by Novell's NetWare/DelWatch protection schemes	Included	Not included

Figure 7. Data Recovery Differences

online books that are provided with PC DOS or other sources. The viewer provides advanced functions such as hypertext links, search, and printing.

Text Editor

The E Editor (Figure 6) is a powerful, full-function tool for browsing or editing files. Many enhancements to the E Editor make it very powerful and easy to use.

The E Editor has full pull-down menu and mouse support. You have the ability to change the E editor's initialization file, which allows for customizing the way that many of the features of E work.

A browse mode is available for files that you want to view without taking the chance of changing. E also has REXX and C autosyntax support, which offers users of either the REXX or C programming language some relative convenience when typing common syntax. Also, working with text files that occupy 132 columns is no longer a problem, because E now has 132-column support.

Once you use the many features of the E editor, any other editor without these features will seem unsatisfactory. For example, two of the most commonly edited files in DOS are CONFIG.SYS and AUTOEXEC.BAT. With this in mind, the PC DOS 7 programmers made it as simple as typing E /C to load the CONFIG.SYS into the E Editor, and E /A to load the AUTOEXEC.BAT into E. And if you want to edit both files, simply typing E /C /A will serve that purpose! In addition, when you load two or more text files, you have full cut-and-paste capability between both files.

Data Recovery

PC DOS 7 provides a full-function, full-screen Undelete program (Figure 7) that allows you to retrieve files that have been inadvertently deleted. For ease of use, both a DOS and a Windows interface are provided with Undelete.

Undelete has three levels of protection. The lowest level of protection is the Standard DOS protection. This gives you the ability to recover files that have not yet been overwritten.

The intermediate level of protection is Tracker. With Tracker protection activated, the clusters that a file occupies are made available. However, a record of the clusters that a file was occupying is made, and as long as the clusters have not been overwritten, there is a good chance of recovering the file.

The highest level of protection is called Sentry. When Sentry is activated, files that are protected by it are saved to a hidden directory, and can be recalled by the Sentry in perfect condition. If the free space on the hard disk is getting low, Sentry will begin to remove the oldest files that are in the hidden directory, so there will be space for other files. Note, however, that with the Sentry level of protection, a lot of disk storage may be used, because whenever a file is "deleted," a backup of that file is created elsewhere on the disk.

PCMCIA Support

Many people today purchase laptops that have PCMCIA card slots. With this in mind, PC DOS 7 now provides PCMCIA support (Figure 8) from Phoenix Technologies. This support is PCMCIA 2.1-compliant.

There are several different types of PCMCIA cards – fax/modem, network, hard-disk (ATA), flash memory, and static random-access memory (SRAM) cards, as well as many other types of peripherals made in a PCMCIA card format. Therefore, it is increasingly important to support these types of cards in a simple, easy-to-use interface. PC DOS 7's PCMCIA support has an easy-to-use DOS and Windows interface.

Most cards are configured automatically by PC DOS 7. By simply plugging the card into the socket, the plug-and-play

	PC DOS 7	MS-DOS 6.22
PCMCIA version / provider	Version 2.1 / Phoenix Technologies	Not included
DOS and Windows interface	Included	Not included
Multi-configuration installation support	Included	Not included
Configurable .INI file to store PCMCIA card information	Included	Not included
Autoconfiguration of standard fax and modem cards	Included	Not included
Enhanced usability (easy to install or uninstall, and to configure)	Included	Not included

Figure 8. PCMCIA Support Differences

	PC DOS 7	MS-DOS 6.22
POWER.EXE driver to conserve energy for PCs with APM support	Included	Included
APM version 1.0 and 1.1 BIOS support	Included	Not included

Figure 9. Advanced Power Management Differences

	PC DOS 7	MS-DOS 6.22
Transfer of files between two PCs using the parallel or serial port	Included	Included
Easy-to-use, full-screen DOS user interface with pull-down menu support	Included	Not included
File synchronization utility that keeps files on two PCs the same	Included	Not included

Figure 10. File Transfer Differences

support for PCMCIA automatically detects the insertion of the card, and readily identifies and configures it. On the small chance that the automatic detection does not recognize the card inserted, PC DOS 7 has an easy-to-use program for configuring the card.

Advanced Power Management

Traditionally, only portable systems (laptops) required any type of power management to reduce the power usage of their batteries. Today, many systems have power management built into the BIOS. With the abundance of machines that now come with Advanced Power Management built in, there was a concern for having the most current support

possible. PC DOS 7 now supports the latest Advanced Power Management (APM) standard (version 1.1), as well as APM 1.0 (Figure 9).

File Transfer

PC DOS 7 now provides a PC-to-PC File Update utility (Figure 10). This utility can synchronize files between two systems using diskettes, parallel/serial connections, or networking software.

This utility is customized so that it ignores specific types of non-data files. It can also be customized to synchronize between multiple environments. For instance, if a laptop machine has a C drive, and a desktop machine has a C

	PC DOS 7	MS-DOS 6.22
Support for CD-ROM drive	Included	Included
Defrag program that reorganizes fragmented files into contiguous files	Included	Included
Quick BASIC programming language	Not included	Included
Scan Disk utility	Not included	Included
DOS/Windows docking support	Included	Not included
REXX programming language support	Included	Not included
Support for pen-based systems	Included	Not included
Scheduling events for unattended use	Included (SCHEDULER)	Not included
Loading selected device drivers from the command line	Included (DYNALOAD)	Not included
Command-line calculator	Included (ACALC)	Not included
DOS full-screen interface/task switcher	Included (DOSSHELL)	Available separately
Installation routine aware of environments using DOS's multi-configuration support	Included	Not included
Configuration Installation Distribution (CID) client	Available	Not available
Comprehensive written and online documentation	Included	Not included
Drive locking lets you lock diskettes, PCMCIA, and CD drives	Included	Not included
Browse files safely without being able to edit them	Included	Not included

Figure 11. Additional Utilities Differences

and a D drive, the user can tell the File Update utility to synchronize the laptop C:\WP51 directory with the desktop D:\WP51 directory. The File Update utility also allows for flexibility in the directory correspondence. For instance, if the same laptop machine has a C:\WP51 directory and the desktop machine has a D:\WP511 directory, File Update can be configured so that it understands this correspondence.

File Update has an easy-to-use, full-screen interface as well as a command-line interface. File Update requires two computers, which are connected via a parallel, serial, or LAN connection. If it is not practical to connect two machines in this way, synchronizing via diskette is another method of transferring the data.

Additional Utilities

There are many other features in PC DOS 7 that add substantial value (Figure 11).

PC DOS 7 has a DEFRAG utility that defragments the files on your hard disk. This can increase the speed of loading files from the hard disk.

Docking support for DOS and Windows allows a user to dock a laptop into a docking station and automatically initiate a configuration for the docking station.

The REXX programming language, included with PC DOS 7, allows you to access a powerful high-level language via a batch file. Along with the REXX

interpreter itself, there is an on-line book providing a quick reference for REXX.

PC DOS 7 also has a utility called DYNALOAD. This enables you to use the command line to load many of the device drivers that are normally loaded in CONFIG.SYS (such as a CD-ROM device driver or a RAM drive). For instance, to load a 1 MB RAM drive in extended memory from the C> prompt, you need only type:

```
DYNALOAD C:\DOS\RAMDRIVE.SYS
    /E 1024
```

DYNALOAD is convenient for people who may not want to load certain drivers due to memory constraints, but still want to have access to their drivers without having to reboot.

ACALC is a simple command-line calculator in PC DOS 7 that can perform simple functions such as 5+5 and complex functions such as `FACT(((8+1)/2*pi())*2-SQRT(MAX(6;3)))`

PC DOS 7: The Clear Choice

The many features, functions, and capabilities in PC DOS 7 distinguish it as the Disk Operating System of choice for beginning, intermediate and power users.

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OS/2 Warp Performance-Tuning

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This article presents general and specific tuning information for a computer that will have or has had OS/2 Warp installed. It starts with some general system setup considerations regarding the processor type, disk type, and the amount of memory in a computer system. Next, it gives details of CONFIG.SYS statements that should never be modified, and those that can be modified to help improve system performance. Next, system and desktop settings are covered. Finally, the article presents memory-usage measurements for different functions and products.

This article assumes that you are familiar with OS/2 Warp and many of the technical terms used in the computer industry.

Before we can discuss the specifics of OS/2 Warp performance-tuning, we must first cover the basics about your computer system, because your system's components are a major factor in the performance of OS/2 Warp.

General Setup Considerations

Essentially, your computer system has three components: processor, memory, and disk.

Processor: In most cases, compared to the amount of memory in your system and the speed of its hard disk, the system's processor has minimal effect on performance.

The only important factor about the processor is its age. At this point, 386 and 386SX processors are relatively slow and should be avoided.

You also want a processor that can be upgraded and that supports instruction caching, sometimes referred to as Level 1 or Level 2 cache. There is really no optimum size for the instruction cache. More instruction cache is usually better than less. The only real factor to consider is cost.

Memory: Memory, also called RAM, is a different story. Without enough memory, your system will run slow.

If you cannot afford to buy memory for your system, then you must manage the things you install. You should install only the fonts, device drivers, objects, and applications that you will actually use.

You may think that, just because you have not started an application, it is not using any memory. This is not always the case. Many newer OS/2 applications will register classes and objects with the Workplace Shell, or add items into PATH statements, SET statements, and the like. Many of these things will cause memory to be used even when the program is not running. Also, in some cases, the program may require special device drivers to be installed, which also uses up memory.

Other things that affect memory usage are disk caches, CD-ROM caches, multimedia support, and buffers. It is important to set up the disk cache for general use after OS/2 is installed. The installation process does not know how the system will be used. If the system is used as a file server or database server, then the disk cache should be modified for

Some terms and phrases used in this article are:

Desktop: Sometimes called the workplace, desktop refers to the Workplace Shell feature of OS/2 Warp. The Workplace Shell is the part of OS/2 Warp that controls how your OS/2 Warp system appears on your computer's display screen.

FAT: File Access Table file system.

HPFS: High Performance File System.

Memory: The amount of physical random-access memory (RAM) that is installed in the computer or used by a particular function.

System: A generic term referring to a computer with an operating system and application programs installed on it.

Working Set: A term that refers to the amount of system memory required to perform a specific task, such as starting an application or loading a file.

that environment. Likewise, if very little file activity will take place, the disk cache should be changed to reflect this minimal level of usage. Refer to the File Systems discussion later in this article for more information about setting up the disk cache.

Disk caches, CD-ROM caches, multimedia support, and buffers all use resident memory. *Resident memory* is defined as the physical computer mem-

ory that is being used. Resident memory itself is not swapped or paged out to disk. But, because resident memory cannot be used by other applications for other purposes, it may therefore cause other data to be swapped to the swap file.

Hard Disk: Probably the most important piece of hardware in your system is its hard disk. The hard disk will affect the performance of starting your system, loading applications, the speed of applications, and the overall performance of your system.

It is best to have a disk subsystem that uses a bus-mastering adapter. Many SCSI devices and some PCI devices have this capability. *Bus-mastering adapters* enable multiple requests, rather than just one command or function at a time, to be sent to the disk to be processed. They also allow what is called *scatter/gather* capabilities.

Without bus mastering, data that is transferred between the computer's memory and the disk must be in contiguous memory, one byte after the other. With bus mastering, the data does not have to be contiguous, and does not have to be on a 64 KB boundary. Bus mastering relieves the system of a lot of overhead, so the system performs faster in actual usage, although you will see little or no difference when running benchmarks.

When the memory in your system is overcommitted – that is, the operating system and the applications you are running need more memory than is physically available in your computer – OS/2 Warp will page, or "swap," code and data that has not been accessed for a while to the disk in order to make room for the currently needed code and data. In this instance, the performance of the disk is the single most important factor in your system.

Another consideration about the hard disk is whether it has its own caching. If it does, and your applications perform

mainly sequential disk access, then you can reduce the size of your disk cache in memory. A hardware disk cache will have little or no effect on performance when applications perform random disk operations. However, the hardware cache will improve the performance of starting the OS/2 Warp operating system and the applications.

File Systems

OS/2 supports two file systems for use on your hard disks: FAT and HPFS. Each of these file systems has some basic considerations.

It is best to have a disk subsystem that uses a bus-mastering adapter.

Your choice of file system should depend on which operating system you will use to access the data. If you plan to boot a native DOS or DOS/Windows system, then all data and programs must reside in a FAT disk partition in order to be accessible. However, if you will only run DOS and Windows applications in an OS/2 Warp VDM (Virtual DOS Machine), your file system can be either HPFS or FAT.

Although you may access a file on a server that uses the HPFS file system, you do not need to install the support for the HPFS file system on your local client computer. HPFS file support only needs to be installed on a computer when a partition on its local hard disk is formatted as HPFS.

The amount of memory you have in your computer should influence your decision about which file system to use. When HPFS is installed, it requires a

minimum of 200 KB to 250 KB of working-set memory, plus the space allocated for its cache. In turn, this reduces by 200 KB to 250 KB the amount of physical memory that is available to programs. This is a large amount of memory to lose, and is the main reason why FAT is used when OS/2 Warp is installed on a system that has 4 MB of physical memory.

Regardless of which file system you select, you need to plan for future requirements: How will maintenance and fixes be applied? Where will applications be installed? Where will data reside? I recommend that, when you set up your hard disk, you create a minimum of three partitions – one for the operating system(s), the second for your applications and static data files, and the third for dynamic data files and temporary files. Also, decide whether you want to use Boot Manager or Dual Boot; if you select Dual Boot, then OS/2 Warp must be installed with the FAT file system.

Temporary Files: Temporary files can be either files allocated by programs that you run, or files that you create to pass information between systems or between processes in your local system. It is better to reuse a file that permanently resides on your system, rather than to create and delete a temporary file every time. One reason is that extending a file can be almost twice as slow as just writing to a file. When temporary files are created, they usually default to a length of zero, and therefore they are always being extended with each write to the file. A second reason is that, if files are reused, it will reduce the fragmentation (discussed later) in your disk directories.

Now let's look at some specifics about the two file systems.

FAT: FAT is best suited for disk partitions that are 80 MB or less in size or that have a limited number of files installed. Usually, 256 files is a good

target for a FAT partition, with up to 500 acceptable.

The number of files becomes important because FAT files are allocated based on a cluster size. The cluster size is determined by the size of the disk partition, and can be 2 KB, 4 KB, 8 KB or higher. Because most file sizes are not an exact multiple of the cluster size, disk space gets wasted.

For example, a 100 MB FAT partition gets a 2 KB cluster size, so installing DOS, Windows, and OS/2 Warp on a 100 MB partition results in wasting 2.2 MB of disk space. This number is calculated by subtracting the actual size of the file from the size allocated in clusters. For example, if the size of the file is 500 bytes, the system would allocate one cluster or 2000 bytes of space, a waste of 1500 bytes. If you use a 540 MB partition, your cluster size increases to 16 KB, and a significantly greater amount of disk space is lost.

When OS/2 Warp allocates space for a file or for data in a FAT partition, it looks for the largest available free space in which to create the file or write the data. If lots of files have been created, deleted, or expanded, the free-space areas become smaller and smaller and are spread out over the disk. This is called *fragmentation*. When a file is fragmented across many areas on the disk, it takes longer to read that data, simply because the disk's read/write head has to do more seeking.

The FAT file system's disk cache is defined by the `DISKCACHE=` statement in the CONFIG.SYS file. New in OS/2 Warp is the `D` designation for the size of the disk cache. If the `D` parameter is present, then each time OS/2 Warp is booted, it allocates space for the disk cache based on the amount of physical memory that is installed in the system.

For example, if more than 8 MB of memory is installed, then 10 percent of
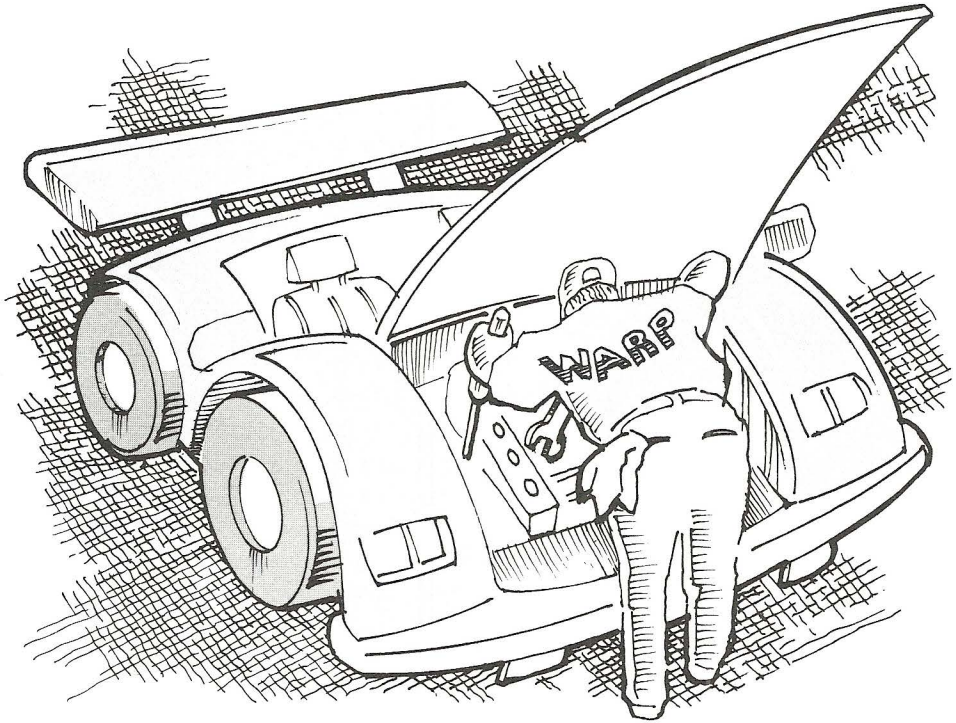
the physical memory is used for the disk cache, up to a maximum of 4 MB. Based on which applications and support you install in your system, this disk cache size may be too high and may cause you to overcommit your memory. If not much disk work is done on your system, or if you are using a product such as DATABASE/2 (DB2), which provides its own disk data caching, then you should reduce the size of your disk cache. A size between 128 KB and 256 KB is sufficient for most systems. On a system with 4 MB of memory, set the disk cache size to 48 KB. The minimum cache size that can allocated is 32 KB, while the largest is 14.4 MB.

Even if you use only HPFS on your system's hard disk drives, the FAT cache, along with lazy writing, is still used for diskette drives. In this case, set the FAT cache size to the minimum 32 KB.

In conjunction with the cache size, you should also set the *caching threshold*. This setting determines which records being written or read can be placed in the cache. The default is a record size of

2 KB, which means that a record larger than 2 KB cannot be placed in the cache and will have to be read again from the disk device if it is needed later. The 2 KB default applies to cache sizes less than 128 KB. If your cache size is 128 KB or larger, increase the caching threshold value to at least 16 KB, and preferably to 32 KB. (More details about this parameter and the `DISKCACHE=` statement are in the CONFIG.SYS section below.)

Some additional ways to improve performance when using the FAT file system are:

- Group files by usage, with the most-used files first, and least-used files last.

- Group files based on whether they are static or dynamic. All dynamic and temporary files should be placed in a separate partition. *Dynamic files* are those that are always changing in size or are being deleted and recreated, whereas *static files* are those that do not change in size. Static files are usually executable code, message files, or help files.

- If possible, place all temporary files in a single directory.

- If possible, use a permanent file instead of creating temporary files.

- Only create directories that you really need. The fewer directories you have to search through, the faster your search will be.

- Defragment your partitions after installing new applications, deleting files, or applying maintenance and fixes. Most DOS defragmentation programs that are aware of hidden files can be used. You may also wish to look at J&J Utilities for OS/2, produced by J&J Computer Consulting, and the different GammaTech utilities produced by SofTouch Systems, Inc. These utilities are aware of EA files and tend to be safer to use.

HPFS: HPFS does away with some of the prevalent concerns of FAT. Files in HPFS are allocated based on a 512-byte granularity instead of a cluster size, so fragmentation is greatly reduced. Also, HPFS is especially efficient when handling large partition sizes (larger than 100 MB) and large numbers of files (more than 500).

In HPFS, you should not allocate more than 5,000 files in a single directory or subdirectory. When you exceed 5,000 files, you start to degrade performance.

The HPFS file system shipped with the OS/2 Warp product has a cache limit of 2 MB. There is no such limit when using the HPFS386 file system that comes with the LAN Server products.

With HPFS, you specify the cache size and the caching record threshold size in the IFS statement in the CONFIG.SYS file. As with FAT, you should specify the caching threshold value, the size of the largest record that can be placed in the cache. The /CRECL parameter is used to define the caching threshold value, by specifying a number in KB. 32 KB is usually a good starting value.

The value must be from 2 KB to 64 KB, in increments of 2 KB. If it is not, the value will be rounded up to the nearest 2 KB boundary.

As mentioned earlier, the big drawback of HPFS is the amount of extra memory that it requires. Even if there is no HPFS partition on your system, it will "cost" between 200 KB and 250 KB in working-set memory, plus the space for the HPFS cache.

If you are installing OS/2 Warp on an existing DOS or DOS/Windows system, you should not install HPFS. When your system is up and running, you can check the working set of your system. The working set can be checked by using tools such as Theseus2, which is a part of IBM's System Performance Monitor/2 (SPM/2) product. If there is enough free memory, if you need about 500 KB, and if you want to create a HPFS partition, then you can use selective reinstall to install the HPFS support. Remember that any data stored in the HPFS partition cannot be accessed if you boot your computer under native DOS.

Another advantage of HPFS over FAT is in the area of extended attributes (EAs). *Extended attributes* are data that is attached to a file to provide information about that file. For example, the name of an object that appears in an OS/2 Warp folder or on the OS/2 Warp desktop is stored as an EA.

In HPFS, EAs are part of the HPFS file control block that is read when the file is opened. In FAT, EAs are stored in a separate file, in separate clusters, and additional I/O time is required to access them, so the use of EAs in the FAT file system is slower.

System Tuning

Before covering OS/2 Warp system tuning, let's review the concept of threads and how they are used in OS/2 Warp.

Every program – DOS, Windows, and OS/2 – that you run on an OS/2 Warp system is processed as one or more threads. All programs use at least one thread. Each thread executes at a given priority. OS/2 Warp uses these priorities to determine which thread gets to run when more than one thread is ready to run. The highest-priority thread that is ready to run is dispatched by the system and is given a set period of time, a *time slice,* in which to run. After this time expires, the highest-priority thread that is ready to run at that point is given its own time slice in which to run. But if the thread that just finished running still wants to run, and it is still the highest-priority thread, it receives another time slice to run in.

OS/2 programs usually run at normal priority, which is 200. Under program control, the program can change its priority to be server class (300) or time-critical (800). It can also change its subclass priority within the range of 0 to 31, and this factor is also taken into consideration. For example, a thread that has priority 200 and subclass priority of 15 has a higher effective priority, and therefore runs before, a thread with priority 200 and subclass priority 0.

All DOS and Windows applications always run at priority 200. New in OS/2 Warp is the capability to define the subclass priority for DOS and Windows applications.

Care should be taken when using the subclass priority, since it may cause other programs to run slower, or may generate errors in the case of communication applications that do not get the subclass boost.

OS/2 Warp gives OS/2 threads a priority boost for specific types of functions and states. A *priority boost* means that the priority of the thread is changed for a given time slice to give it higher priority than other threads. This allows these threads to process more quickly and

therefore to improve their responsiveness to the user.

Following is a list of priority boosts, in highest-priority to lowest-priority order, that can be given to a thread:

Disk I/O: When an interrupt is received indicating that a disk operation has completed, the thread that processes this state receives a priority boost for one time slice to process the interrupt. This applies to a thread whose process has *foreground focus* – that is, the process owns the window that is highlighted on the display screen.

Starved: In the CONFIG.SYS file, there is a statement `MAXWAIT=3`. The number 3 specifies how many seconds a thread can be in the ready-to-run state without having received time to run. If a thread has been waiting to run for three seconds, or whatever value is specified in the `MAXWAIT` statement, its priority will be raised to give it an opportunity to run.

Keyboard: This is a boost in priority given to a thread when it interacts with the system keyboard. Basically, this boost is for accepting typed-in data.

Foreground: This is a priority boost given to all threads of the program that owns the highlighted (active) window on the OS/2 Warp display screen.

Windowed: Threads that have windows showing on the display screen will also receive a priority boost when drawing or writing into that window.

When a thread is in more than one of these states, the system will combine the states and issue a priority based on the combined states.

For DOS and Windows applications, the foreground, windowed, and keyboard states do not apply. The routine that handles the mouse or keyboard interrupt receives a boost in priority to handle the interrupt, but the application itself does not receive a priority boost. If the DOS setting `INT_DURING_IO` is specified, a second thread is used to handle the I/O interrupt, and that thread is given an interrupt boost.

Idle class is the other priority class that exists in OS/2 Warp. This level of priority runs only when nothing else in the system wants to run. Threads in this class receive none of the state boosts. If DOS or DOS/Windows applications are being run, then you should avoid the use of threads that run in idle class, because they may never run but will take up system space.

CONFIG.SYS

Now let's look at specific things in the CONFIG.SYS file that you should not modify, as well as things you can change to affect the performance of your system.

Statements that Should Not Be Changed: First, we cover the statements that you should *not* modify unless you have a system that has a special use, such as a process-control system. An example would be a system used to monitor a manufacturing machine or chemical process, where timing and response time are critical factors.

PRIORITY_DISK_IO=YES

This statement allows the application that has screen focus to receive a priority boost when its disk operation is complete. This boost applies to the first time slice given to the thread after the disk operation is complete. After the time slice, the state is reset for the thread, and the priority boost is removed.

MEMMAN=SWAP,PROTECT

This statement allows OS/2 Warp to swap program instructions and data to disk when more memory is needed than is physically available in your computer. If you do not specify `SWAP`, you will need to have enough physical memory in your computer to hold all the program instructions and data that OS/2 Warp and your application require to run. In contrast, you do not pay a penalty by specifying `SWAP` and then not needing to use it.

The `PROTECT` parameter allows Dynamic Link Libraries (DLLs) to allocate *protected memory,* which is memory that is protected from being accessed by unauthorized programs.

You can also specify a `COMMIT` parameter. This parameter forces the system to ensure that enough physical memory or swap-file disk space is available for a memory object when it is created. (Normally, OS/2 Warp commits physical and disk memory when the page of memory is actually touched.) Specifying this parameter can significantly increase the amount of space your swap file uses on disk. In most cases, you should not use the `COMMIT` parameter. Usually, you specify `COMMIT` only if you are developing applications or systems and you want to determine the maximum amount of memory and disk space that could be required.

TIMESLICE=X,Y

This statement is not found in the CONFIG.SYS file, but it was sometimes recommended to be added. Adding it was okay for OS/2 2.0, 2.1, and 2.11, but it is not okay for OS/2 Warp.

OS/2 Warp dynamically modifies a thread's time slice based on actions that have occurred. For instance, if a thread took a page fault during its time slice, it gets an extra time slice to process what is contained in the faulted page. Also, applications doing disk I/O get extra time slices if the data they are reading is in the disk cache.

When the `TIMESLICE=` parameter is used, none of these actions occurs. Instead, each thread is given the minimum time slice of `x,` and its time slice

will not be allowed to go beyond the value **Y**.

PRIORITY=DYNAMIC

If **DYNAMIC** is not specified, then each thread runs only at the priority that has been assigned to it by the developer of the code. None of the priority state boosts described earlier are applied.

DEVICE=C:\OS2\BOOT
  \VDISK.SYS

This statement allocates a virtual disk in your computer's physical memory. It is used for quick access to frequently used files and programs. This was fine for a DOS environment, where the extra memory in your computer was not used by DOS; but OS/2 Warp uses this memory, so your system's performance can be adversely affected if a VDISK is used.

If you have unused physical memory, it is much better to increase the size of the disk cache than to use VDISK.

Statements That Should Be Changed:
Now, let's look at statements in CONFIG.SYS that you should change to help improve the performance of your OS/2 Warp system.

LIBPATH=.;C:\OS2\DLL;
  C:\OS2\MDOS;
  C:\OS2\APPS\DLL;

This statement tells the system where to find DLL files and printer device drivers used by OS/2 Warp and applications. Place the directory names in order of usage, with the most-accessed directory first, and the least-used last. For example, if you have an application that uses its own DLL very frequently, and you install that application into the directory MYDLL on the D: drive, you could place the MYDLL directory into the **LIBPATH** statement, as follows:

LIBPATH=.;D:\MYDLL;
  C:\OS2\DLL;C:\OS2\MDOS;
  C:\OS2\APPS\DLL;

If possible, place the DLL used by a program into the working directory when the program is running. The *working directory* is the one being used by the executing application. For example, if you start program XYZ from a directory ABC on the D: drive, then the working directory is D:\ABC.

If the DLLs being used exist in the working directory, then the directory does not have to be added to the **LIBPATH** statement.

Also, place all directories that are on a network at the end of your **LIBPATH** statement, in case the network goes down and they cannot be accessed. When you try to access a network drive that is not active, you will have to wait for an error timeout to occur before processing can continue. This can be as much as 15 seconds or longer. (See the discussion of dynamic LIBPATH support later in this article for additional considerations when accessing network drives.)

SET PATH=C:\OS2;
  C:\OS2\SYSTEM;C:\;
  C:\OS2\MDOS;
  C:\OS2\MDOS\OS2WIN;

PATH is used to specify where OS/2 Warp searches for executable program files (EXE, COM, CMD, BAT, etc.). Place the directories in order of most-used first, least-used last. If programs will be executed from an object on your desktop or folder, specify the path within that object's settings rather than in the **PATH** statement. In the **PATH** statement, place only those directories that contain executable files that will be called from other programs, command interpreters, or command-line interfaces.

SET DPATH=C:\OS2;
  C:\OS2\SYSTEM;
  C:\OS2\INSTALL;
  C:\OS2\BITMAP;

DPATH is used to define the search path for finding data files. The same principle that applies to **PATH** and **LIBPATH** also applies to **DPATH** – for resources that applications use, place the most-used directories first and the least-used last.

BUFFERS=90

The **BUFFERS** parameter specifies the number of 512-byte blocks that are used to support partial-sector reads and writes in a FAT file system environment, for caching FAT directory entries and for swap-file I/O. The number of blocks defined should not be reduced below 60, unless you are not using the FAT file system on your disks. Reducing the **BUFFERS** number will increase the number of disk reads that are done to the FAT directory entries, and therefore slows down your system.

MAXWAIT=3

This statement specifies the maximum amount of time, in seconds, during which a thread is ready to run but does not receive a time slice to run in. After this time expires, the thread is given a boost in priority so that it gets a chance to run. Reducing the **MAXWAIT** value to 2 seconds may help in systems in which a lot of programs, or multiple separate DOS/Windows programs, are running. However, reducing it to 1 on systems where swap activity takes place can slow down the system.

DISKCACHE=D,LW,t,AC:

This statement specifies the amount of physical memory set aside to cache data that is being read from or written to FAT disk partitions. When OS/2 Warp sees **D** in the **DISKCACHE** statement, it allocates a disk cache size from 48 KB to 4 MB, based on the amount of physical memory in your system. If you have more than 8 MB in your system, the presence of **D** causes 10 percent of your

system's physical memory to be used for the FAT disk cache.

Instead of specifying D in the DISKCACHE statement, you should replace it with the actual amount of disk cache space you require. For example, if you have a system where your programs do not do much disk I/O, or where your memory is being used up by your applications, you may want to set this value to 128 KB. Also, reduce this value if you are using the DB2 product or any other product that provides its own disk data caching. If you have a system with lots of memory, you can specify a number bigger than 4 MB. The maximum allowed is 14.4 MB.

The t parameter is not defined in the default CONFIG.SYS file. For the value of t, you would specify a numeric value that defines the caching threshold for records that go into the cache. The default value is 4 KB. This means that any record that is 4 sectors or less in size will go into the cache, while those larger than 4 sectors will not. If your disk cache size is 128 KB or larger, add this parameter to the disk cache statement. If you know the size of the largest record you will use, set this value to the largest record size used. Otherwise, set the value to 32 KB. The range can be from 2 KB (4 sectors) up to 64 KB. I use 32 KB because it is a good starting point, big enough to handle most applications and program executable files.

The LW parameter activates the Lazy Write or write-behind feature. This allows the application to regain control before the data is actually written to disk. A separate thread will write the data from the cache to the disk when necessary or opportune to do so. When disk data security is imperative, you should always use this option and code your applications to open files with a cache-bypass option.

The AC: parameter is used to specify which FAT partitions should be checked at system boot time to see if they were left in a unpredictable state when the system was last powered off. This usually occurs when the electric power to your computer is lost, and you had not done a shutdown or Ctrl+Alt+Del rebooting sequence prior to losing power. The disk partitions specified here will have CHKDSK run against them to clean up any lost files or abandoned clusters. For example, if you want to have partitions C: and D: checked, you would enter AC:CD.

SWAPPATH=d,r,s

This statement specifies where code and data pages are swapped to on disk when more physical memory is needed than is available in your system.

The d parameter represents the path where your SWAPPER.DAT file is located. For systems that have multiple partitions or multiple disks, the SWAPPER.DAT file should be placed in the most-used directory of the least-used disk. Also, try to physically locate the swap file on the disk based on its usage – if you are doing a lot of swap activity, place the swap file at the start of the disk, but if is it rarely used, place it at the end.

The s parameter specifies the size to which the swap file is initialized when you start your OS/2 Warp system. Make this value large enough so that the swap file does not have to grow in size while you are running your programs.

You should perform your normal computer functions and look at the size of the swap file when you have the most activity. Then set the value of s to this size. If you are using the FAT file system, boot your system under DOS, delete the SWAPPER.DAT file, defragment the disk partition where the swap file will be located, and then boot your OS/2 Warp system. This should prevent your swap file from getting fragmented.

The r parameter specifies the amount of free space that must be in the swap file's drive. The default for this value is adequate, and only needs to be changed if you want to be warned earlier about a possible out-of-memory situation.

THREADS=

THREADS defines how many threads the system will be able to use. One page of resident memory is needed for approximately every 32 threads that are defined. This memory is allocated when the system is booted.

As a minimum, you will need 80 threads to support the base OS/2 Warp operating system plus three or four OS/2, DOS, and DOS/Windows applications. The system supports up to 64,000 threads, but typically you will not have enough memory in your system to support more than 300 to 500 threads.

Thread requirements of some applications are: 18 for LAN Server 4.0, 12 for Personal Communications/3270, and an additional two threads for each Personal Communications/3270 session that is started.

To calculate the number of threads that you will need in your system, use the formula 54+(2N)+10, where N is the number of programs that you will run simultaneously. If a program requires more than two threads, add in the extra threads. This calculation will ensure that you have enough threads in most cases.

To determine how many threads you are using at any given time, run the PSTAT command from an OS/2 command line. This command shows all of the processes that are running on your system, as well as how many threads each process is using. The output is quite long, so you may want to redirect it to a file for later viewing or printing.

Additional CONFIG.SYS Considerations

You should only install the device drivers that your programs actually require to run. Do not install extra communication, printer, video, or device drivers if they will not be used.

Below are a list of device drivers and virtual device drivers that are normally found in CONFIG.SYS, but which may not be needed. (Virtual device drivers are used to support DOS and DOS/Windows applications, and usually have a V at the beginning of their names.)

- VEMM.SYS supports the use of expanded memory in DOS and Windows programs.
- VXMS.SYS supports the use of extended memory in DOS and Windows programs.
- VDPMI.SYS supports the DPMI memory access, and is required to support all Windows programs.
- VW32S.SYS supplies support for the WIN32S Windows APIs. It is not needed for Windows programs that do not use WIN32S APIs.
- IBM1FLPY.ADD and IBM2FLPY.ADD – IBM1FLPY.ADD is used for Family 1 (AT-bus) computers, and IBM2FLPY.ADD is for Micro Channel computers. You do not need both.
- XDFLOPPY.FLT is required for reading diskettes that are written using the XDF (eXtended Disk Format) format. These are usually OS/2 Warp and PC DOS 7 installation, printer, video driver, and possibly corrective-service diskettes. The OS/2 Warp Install and Disk 1 diskettes do not use the XDF format.
- COM.SYS and VCOM.SYS are only required if you will be doing serial or async communications.

If you use the selectable CONFIG.SYS option in the Archive and Retrieval feature of OS/2 Warp, it is possible to create multiple CONFIG.SYS files that contain different device drivers based on your needs. For example, you could create one CONFIG.SYS file that is used for maintenance and installation. This CONFIG.SYS would include XDFLOPPY.FLT and both IBMxFLPY.ADD drivers, plus additional threads. Another CONFIG.SYS used for normal processing could have these device drivers removed, and a lower number of threads. When maintenance must be applied to the system, or some additional new products are to be installed, you could boot the computer with the Archive and Retrieval menu active, and select the appropriate CONFIG.SYS to use. An extension of this would be to archive the CONFIG.SYS and the OS/2 INI files, and select those archived files before applying maintenance.

System Settings

Let's look at some of the system settings and desktop settings that can be tuned to improve a system's performance. In the System Setup folder, there are many utilities that are available.

Spooler: The drop-down menu of the Spooler icon in the System Setup folder provides an option to disable the spooler. This can be done without problems when only one job at a time is active on your printer. Disabling the spooler saves a little bit of memory and one process and thread in your system.

If you have a dedicated print spool computer, then you should raise the priority of the spooler to its highest point. For non-dedicated print spool systems, the priority should remain at the default. You should only increase the priority if (for example) you raised the subpriority of a DOS session and wanted to print documents while running the DOS session. In this case, you should make the priority of the print spooler the same as the priority of the DOS session.

Schemes and Color Palette: You should use solid colors and avoid the use of bitmaps for desktop and folder backgrounds. Selecting either mixed colors or bitmap backgrounds uses more memory and requires more processing time to display them.

Sounds: Deselect the System Sounds options, unless you like the noises when opening and closing your folders. It costs between 250 KB and 300 KB in working set just to hear the noise.

An additional 40 KB or so of working-set memory can be saved by executing DINSTSND.CMD in an OS/2 command session. This unhooks the system sounds from the OS/2 Warp desktop. To get them back, execute INSTSND.CMD.

Font Palette: Install only the fonts that you will actually use in your system. Also, try not to mix fonts in folders or on the OS/2 Warp desktop. If you do, you will be using extra memory. Outline fonts tend to require a little less memory than bitmap fonts, and once they are in the cache, they perform just as fast.

WIN-OS/2: When defining a Windows program, select common sessions and make both DDE and clipboard support private.

If floating-point is used in your Windows applications, use the enhanced run mode for Windows. This can give as much as a 20 percent gain in performance.

If you have a Windows application that you always run, it is better to start it via the Startup folder than to use the Fast Load option and start it from the desktop.

When you migrate Windows applications or add Windows programs to your system, ensure that their run mode is the same as the common session's run mode. If the run modes are different, you will have two separate Windows

sessions running, even though you specified to use a common session.

If you get errors that say the system is unable to allocate buffers or other resources when using a common session, try using enhanced run mode rather than standard run mode for that session. This usually clears up these errors when there is enough system memory available.

System Setup: Disabling the Animation and Print Screen option can save a little in the code path, number of program instructions executed, and memory.

Setting the System Logo option to none can save some time when loading applications that check this parameter to see how long to display their application logo.

Disabling the type-ahead option saves a little memory.

When selecting screen resolutions, remember that the higher the resolution and the more colors, the more memory is used. For example, very high resolution and color support can require 100 KB to 200 KB of physical memory. If you don't need these things, select a lower screen resolution with fewer colors.

Mouse: Mouse pointers are basically bitmaps. The amount of memory used will be affected by which mouse pointer style you choose. If you activate the comet cursor, it costs additional memory and processing time whenever the mouse is being used.

Desktop Settings: Desktop settings are selected by choosing the Settings option on the desktop menu. Choosing Automatic Lockup requires extra code path and processing time. Normally the effect is very minimal until the timeout value expires. At that point, you are using about 40 KB to 50 KB of working-set memory.

If you select Create Archive on system restarts, it slows down your system's boot time. Set this option only when you have changed your desktop and/or configuration and want to save it. Once it has been saved, turn this option off. You can get to the Archive and Retrieve menu screen when you boot your system by using the Alt+F1 key sequence.

Use OS/2 Warp to Your Advantage

All the bells and whistles, neat features, applications, and devices discussed above come at a cost. They all cost disk space, use memory, and have the potential for slowing down your system.

You can set up the system with different configurations and different support, designed to optimize performance based on the particular functions you perform and applications you use.

To minimize their impact, plan ahead. Decide what your system will be used for, now and in the future, and set up the system accordingly. Install only the things that you are actually going to use. Ensure that there is a match between the software you install and the hardware you install it on. If an application or feature costs more memory than you have, either don't install the feature, or get more memory for your system. Finally, be creative and logical – you can set up the system with different configurations and different support, designed to optimize performance based on the particular functions you perform and applications you use.

Become aware of what OS/2 Warp has to offer, and use it to your advantage!

Memory Usage Measurements

The memory usage measurements presented in Figures 1 through 5 are for planning purposes only. There is no guarantee, implied or otherwise, that you will reproduce these numbers exactly on any other system. Measured results will change based on the hardware configuration of your computer, and on which software is installed in the system. If the hardware or software configuration changes, the results will also change.

All numbers are presented in megabytes (MB) of memory unless otherwise noted, and they indicate all the physical memory that is used to execute a given function. This includes memory for the OS/2 Warp operating system, application programs, and data.

All measurements were made on an IBM PS/2 model A21, with 16 MB of memory, VGA video, ESDI disk, mouse, keyboard, and 16/4 Token Ring adapter. HPFS and multimedia support were not installed in the base system. The CONFIG.SYS file was modified to be equivalent to how it would look on a 4 MB system – `DISKCACHE=48,` `THREADS=96,` and no `IFS` statement for HPFS.

In Figures 1 through 4, OS/2 Warp for Windows is the version (in the red product box) that uses an existing Windows installation, whereas OS/2 Warp with WIN-OS2 is the version (in the blue product box) that comes with IBM's WIN-OS/2 emulation of Windows.

In Figure 1, the memory requirements for DOS and Windows sessions are for full-screen sessions, and therefore include the working-set memory for switching back to the OS/2 Warp desktop to stop the measurement process.

Memory Requirements		
Function	OS/2 Warp for Windows	OS/2 Warp with WIN-OS2
Open the System folder	3.6 MB	3.7 MB
Open command prompts	3.5 MB	3.6 MB
Start a DOS session	4.5 MB	4.6 MB
Exit the DOS session	4.3 MB	4.3 MB
Start a Windows session	6.3 MB	6.0 MB
Exit the Windows session	5.3 MB	5.3 MB
Open the Productivity folder	3.5 MB	3.6 MB
Start the Enhanced Editor	4.5 MB	4.6 MB

Figure 1. Memory Requirements for Some Common Activities

Function	OS/2 Warp for Windows	OS/2 Warp with WIN-OS2
Open DOS window session	4.16 MB	4.15 MB
DIR command in DOS window	3.00 MB	3.00 MB

Figure 2. Memory Requirements for a DOS Session in a Window

Function	OS/2 Warp for Windows	OS/2 Warp with WIN-OS2
Start PROGMAN	6.17 MB	5.84 MB
Open the Windows "Main" folder	3.51 MB	3.50 MB

Figure 3. Memory Requirements for a Windows Session, Standard Run Mode, Public DDE and Clipboard

Function	OS/2 Warp for Windows	OS/2 Warp with WIN-OS2
Start PROGMAN	5.86 MB	5.69 MB
Open the Windows "Main" folder	3.39 MB	3.35 MB

Figure 4. Memory Requirements for a Windows Session, Enhanced Run Mode, Private DDE and Clipboard

Support	Additional Working-Set Memory

Multimedia
    Device drivers
    Desktop folder and objects
    System sounds
	50 KB
	100 KB
	40-300 KB (Inactive vs. active)

Save desktop	300 KB
HPFS	200-400 KB (No HPFS partition defined, and 64 KB cache)
XDF support	50 KB

Personal Communications 3270
    Support not started
    Support active
        Minimum
        Maximum
	< 20 KB
	
	300 KB (Single session; numbers do not
	450 KB include connection protocol)

TCP/IP	500 KB (Base support) (For the device drivers installed by the BonusPak)

LAN Requester 4.0
    Device Driver and Setup
    Requester Active
	1 MB (Default installation for Token Ring including
	700 KB LAN Messaging support)
	300 KB

Stacker 4.0	150 KB

Figure 5. Memory Requirements of Additional Support

Figure 2 shows memory requirements for starting a DOS session in a window, and for starting the Windows PROGMAN support in a window (called a *seamless* session). All numbers shown constitute the total amount of memory used for the particular function.

Figure 3 gives memory requirements for a Windows session with standard run mode and public DDE and clipboard support.

Figure 4 lists memory requirements for a Windows session with enhanced run mode and private DDE and clipboard support.

As can be seen in Figures 2 through 4, the way you set up your sessions can have a significant impact on the amount of memory used.

Figure 5 shows how much memory is required when particular support is installed or activated on your system. These numbers are presented in kilobytes (KB). For example, Save Desktop costs 300 KB in working-set memory, so if the desktop was being saved while the System folder was being opened, 3.9 MB of memory would be required instead of 3.6 MB. The numbers in Figure 5 are *in addition* to those in Figures 1 through 4.

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OS/2 is for Work - Not for Play

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(Reprinted with permission from The Southwest Florida PC User's Group Newsletter, *March 1995 issue. This is a letter to the editor of that newsletter.)*

Dear Mr. Editor:

Bill Gates sure knows his audience. He's got even you fooled. For the average Jane/Joe who doesn't need to be productive and has time to spare and wants to be entertained, Windows is the answer. It does games, and how! And music; it'll play tunes to your heart's content.

What's ironic is that you made your final decision based on fun, not profit. But for those of us for whom *work* is important, and saving time, and being productive – well, Windows itself just doesn't make it.

You use your computer for business, you say. So you tried OS/2. It gave you great productivity, stability, crash protection, multitasking, flexibility, configurability. But to play certain games, you had to reboot to pure DOS, and that was just inconvenient. But crashes aren't? And costly, considering lost data, time, and emotional stress? And not all your games wouldn't work in OS/2; most do.

Tell me, why didn't you give up on DOS years ago? Or Windows, when the early versions wouldn't do everything you wanted? We stayed with these, learned them, and moved along with them as new developments occurred. The more we supported them, the more improvements were made. The more we used them, the more products developed which used them. We persevered, we tweaked, and stroked, and cajoled, and kept improving our knowledge. And the products just kept getting better. Because we were there using them.

OS/2 does *today* what many wish DOS and Windows would do. So why are people afraid to experiment? How many times have you "re-done" your configuration, partitions, etc. because you wanted your hardware and software set up differently? How many moans and groans have you gone through in the past, and why are the ones you experienced with OS/2 unique? "Because I expected more," a PCUG member told me once. I'm surprised that person, or anyone else with that attitude, even owns a computer. Because certainly they expected *more* when they first bought it and didn't *get* more.

What do you need new applications for, if you like the ones you have now?

A recent article in *Forbes* magazine suggests that people not try upgrading hardware "pieces" but instead upgrade entire systems, because so much time is lost trying to make things work together. And this was in reference to Windows!

Finally, all you folks out there, know that I called the editor first before writing this, because he's a friend and I didn't want to start a "family feud." I won't speak for him, but I think he sees the irony in his review. His final statement about OS/2 was of particular interest: "But there are so few new programs and fonts to use with OS/2." And that, my friends, is the beauty of OS/2. It gives you the best of ALL worlds. What do you need new applications for, if you like the ones you have now? Just run them *inside* OS/2 and get all the benefits of your apps *and* OS/2. You don't need Adobe fonts unless you buy OS/2-specific programs (and then get the really extra-special benefits of 32-bit computing!); and then you can get fonts from Adobe. Finally, the more people use OS/2, the more choices there will be. But who cares, when you can get your project done fast and efficiently with the software you already have.

An operating system should help you operate (OS/2), not interfere with your operation (DOS/Windows).

In closing, games are important. They reduce stress, test intelligence and motor skills, and even educate. All laudable activities. Perhaps "work" is the real problem here...

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Why Are You Still Waiting for Microsoft?

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Why are you still waiting for Microsoft to deliver a 32-bit operating system?

You say you have a big investment in Redmond Billy's DOS/Windows 3.1 applications? No problem, they'll run under OS/2. And OS/2 is available (Win95 isn't), bulletproof (Win95 is a long shot), and inexpensive (Win95 won't be).

You had to buy third-party memory managers to make DOS/Windows 3.1 work as it should? With OS/2, you won't need them anymore. OS/2 uses your memory in linear configuration. If you have 8 megabytes of RAM, OS/2 uses 0 to 8 MB as required by your programs. OS/2 has no 640 KB maximum program size limit, with extended and/or expanded memory mapped out in 64 KB pages and shuffled around, or any of that inefficient stuff. If you have 8 megs, then OS/2 sees and uses (if required) all 8 megs. If you still insist on running your old DOS/Windows programs: OS/2 allocates 640 KB of memory for your old program (say Excel). If you want to run a second program (say WordPerfect), then OS/2 allocates another 640 KB. OS/2 does this for your third, ..., nth programs, until all 8 megs are used. If you still want to run more, then install more RAM.

Why buy OS/2 to run just old DOS/Windows programs? What's that you say – there are no good or no inexpensive (or no available) OS/2 programs?

If you believe this, then you're misinformed – probably from reading too many PC magazines that talk incessantly about Windows stuff because they worry they'll lose Microsoft's and Windows application vendors' advertising dollars if they give good coverage of anything competitive. It's no problem in *The HUG Update* – we don't get paid by Microsoft or anyone else.

You say that Windows 95 is around the corner? What makes you think it will run any better than any previous radically new (for Microsoft) product?

Remember Windows 1.0, Win 286, Win 386, Windows 2.0, Windows 3.0? It took those many versions just to get their 16-bit operating *environment* ready for prime time. A Windows user requires MS-DOS 6.x with Windows 3.1/3.11 with Quarterdeck's QEMM memory manager and Stac Electronics' Stacker to adequately run current 16-bit application programs. This whole flock of Windows stuff can be replaced by IBM's OS/2 operating system, as it comes out of the box.

Where can you buy OS/2 and the OS/2 applications that are readily available?

Indelible Blue, Inc., at 1-800-776-8284, advertises that it has "Hundreds of OS/2 Native Applications Available, NOW." Call these folks and ask for their *OS/2 News & Blues* newsletter. It has the best product descriptions of any newsletter around. Their prices are low and their service is outstanding. If you are interested in OS/2 products get on Indelible Blue's mailing list, *now!*

Lotus Selects at 1-800-635-6887 has the Lotus AmiPro word processor, 1-2-3 spreadsheet, Freelance Graphics and cc:Mail available in its OS/2 SmartSuite bundle. Or, buy any of these applications separately at competitive prices.

IBM Direct at 1-800-342-6672 has a catalog that boasts there are "over 100

desktop software products inside." PC Connection had the SmartSuite on special (April/May) for $129.95. Is that inexpensive enough? Compare that price against Microsoft's Office for Windows.

Mesa 2 spreadsheet from Athena Design at 1-617-734-6372 is a spreadsheet to consider if you need an easy-to-use OS/2 spreadsheet. A free upgrade for registered users has just been announced. Corel offers its graphics application software in a version for OS/2.

There are also *tons* of OS/2 freeware and shareware programs for users who like the shareware approach of "trying-before-buying" their software. These OS/2 programs were created by programmers who are more competent than their DOS-only counterparts. CD-ROMs are available through mail order or at the computer shows, such as Hobbes OS/2, OS/2 Mate, *OS/2 Professional,* Dr. OS/2, The Companion for OS/2, etc. Each disk contains, typically, over 1000 programs. Freeware and shareware programs can also be downloaded from our user group BBS.

In summary, if you are ready to step up to a true 32-bit OS, get OS/2 Warp Version 3 to be installed on top of existing DOS and Windows, or get OS/2 Warp Version 3 with WIN-OS2 with Windows 3.1 integrated into the package. Then order the application programs necessary for your work (or play). I did and I'll never go back to Windows – the rewards are too great.

Lou Samsel, a member of the Harrisburg PC User Group for ten years, is a valuation engineer for the Pennsylvania Public Utility Commission, making technical recommendations about telecommunications issues. He has worked at the commission for ten years; He also worked for Bell Telephone and RCA. Lou is treasurer of the American Statistical Association. He has BBA and MA degrees in economics from The Pennsylvania State University.

OS/2 TCP/IP Questions and Answers

Bertram Glenn Moshier
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Editor's note: Bert Moshier is joining the editorial staff of IBM Personal Software *magazine as our Internet contributing editor. Over the next several issues we will add articles about OS/2 and the Internet. Bert will answer your questions about OS/2 and TCP/IP using this column.*

Q: I recently installed both Zip Stream by Carbon Based Software and OS/2 Warp Connect. I would like Zip Stream to compress my Ultimail Lite mail storage directories (c:\tcpip\umail\mailstor). But Zip Stream shadows my C drive as X. Hence, the uncompressed files would reside as x:\tcpip\umail\mailstor.

Using the TCP/IP configuration notebook simply to change the C drive to X won't work. One possible method to use the notebook is to play a shell game – move the directory to an intermediate point, and then finally to the x:\tcpip\umail\mailstor directory.

Is there a simpler way?

A: Yes, there is a simpler way than "playing a shell game."

Author's note: Zip Stream supports mounting entire drives or subdirectories. The first part of this answer discusses the changes necessary when you mount the drive with the Ultimail Lite mail storage directory. The second part covers the changes necessary when you mount the Ultimail Lite mail storage directory as a drive letter. In their Zip Stream documentation, Carbon Based Software suggests mounting entire drives.

```
:ACCESS user      = '*'
        info      = 'RULE'
        mailstore = 'C:\TCPIP\UMAIL\Mailstor'
```

Figure 1. ACCESS Lines in UMAILSRV.PRO

```
mailstore  = 'X:\TCPIP\UMAIL\Mailstor'
```

Figure 2. Line to Change in UMAILSRV.PRO

```
:PROFILE provider    = 'ADVANTIS'
         file        = 'C:\MPTN\ETC\TCPOS2.INI'
```

Figure 3. PROFILE Lines in UMAILSRV.PRO

You are correct that using the TCP/IP configuration notebook to change c:\tcpip\umail\mailstor to x:\tcpip\umail\mailstor won't work.

You need to perform the same change to TCP/IP data files as the configuration program would perform. Two changes are necessary to accomplish your goal.

First, you need to change the Ultimail Lite Server profile. The file name is UMAILSRV.PRO. This file is normally in the c:\tcpip\umail directory when using the defaults for installing OS/2 Warp Connect's version of Ultimail Lite. In UMAILSRV.PRO, you'll find a section as shown in Figure 1.

You need to change the `mailstore` line in Figure 1 to the line shown in Figure 2. You may use your favorite editor; no special characters are in the file.

Second, you need to change the TCP/IP for OS/2 Warp Connect INI file. The name of this file, by default, is C:\MPTN\ETC\TCPOS2.INI for an OS/2 Warp Connect installation using the multiple transport protocol support. You can either verify the file name or

find it by looking at the lines in UMAILSRV.PRO shown in Figure 3.

For this modification, the application name is `LAN`, the key is `MAIL_STORE`, and the value change is from `C:\TCPIP\UMAIL\MAILSTOR` to `X:\TCPIP\UMAIL\MAILSTOR`. Note that case is important.

Zip Stream also allows you to attach (i.e., mount) subdirectories instead of entire drives. An example is shown in Figure 4. For this modification, the application name is `LAN`, the key is `MAIL_STORE`, and the value change is from `C:\TCPIP\UMAIL\MAILSTOR` to `M:`. Note that case is important.

(I would like to thank Dr. Juerg Von Kaenel, manager of the Ultimail group at the IBM T. J. Watson Research Center, for his review of this answer.)

Q: I notice that many corporations provide e-mail support in the form of userid@domain. As hard as I've tried, I can't figure out how to accomplish this same level (type) of e-mail support using OS/2 Warp Connect. I'd like to use OS/2 Warp Connect exclusively at my company; yet, userid@domain is

```
ZSATTACH M: C:\TCPIP\UMAIL\MAILSTOR
```

Figure 4. Attaching Subdirectories in Zip Stream

```
Domain:     os2warp.com
Hosts:      ns (ns.os2warp.com, 9.227.13.35),
            sneakers (sneakers.os2warp.com),
            and
            rose (rose.os2warp.com);
            also
            emi.net (another domain)


Hosts       Userids

ns          None of its own
sneakers    bgm, postmaster, bert
rose        juanita, jcm
emi.net     myg (markg@emi.net)
```

Figure 5. Our Fictional Domain

Mail addressed to	Goes to (userid@host.domain)
bgm@os2warp.com	bgm@sneakers.os2warp.com
postmaster@os2warp.com	postmaster@sneakers.os2warp.com
bert@os2warp.com	bert@sneakers.os2warp.com
juanita@os2warp.com	juanita@rose.os2warp.com
jcm@os2warp.com	jcm@rose.os2warp.com
myg@os2warp.com	markg@emi.net

Figure 6. Mail Addresses and Their Corresponding Users

important enough to justify using some version of UNIX or even Microsoft Windows NT.

A: OS/2 TCP/IP 2.0 or 3.0 can accomplish your desire in three steps. The first is adminstrative, and the last two are configuration file changes and creation.

The best way to understand the first step is to review exactly what you desire. For this discussion, let's use the fictional domain specified in Figure 5.

The objective is for the e-mail addresses using the form userid@domain to arrive in the proper userid inbox. For example, bgm@os2warp.com should go to the userid bgm F255P255D on the sneakers workstation (host).

Step 1

Step 1 has two parts. In part 1, you need to determine which host will process all incoming mail using the form userid@domain. An example is having os2warp.com resolve to ns.os2warp.com.

In part 2, you need to determine the e-mail form that each userid in your domain will use. You have two choices: userid@domain and userid@host.domain. Those userids using the userid@domain form must be unique throughout the domain. This discussion covers only the userid@domain e-mail form.

Hence, based upon our fictional domain, our first part is to assign a machine (host) to be os2warp.com. For this fictional domain, ns.os2warp.com serves this purpose. Incoming mail to the os2warp.com domain arrives at the ns.os2warp.com host. This host then redirects and resends the mail to the host where the user is.

Our second part is to list the mail addresses and who receives the incoming mail. For example, bgm@os2warp.com goes to the user bgm on the host sneakers.os2warp.com. The remaining correspondences are listed in Figure 6.

In Figure 6, the last entry (myg@os2warp.com) shows two possibilities that you may find useful. First, mail for userids in your domain doesn't have to go to hosts in your domain. The mail can go anywhere on the Internet you desire, including to another domain, using the e-mail form userid@domain. In our example, the userid myg goes to the emi.net domain, which also supports the userid@domain format. Second, an external userid (e.g., myg) does not need to be the same as its internal counterpart (e.g., markg).

What makes this all possible is support for sendmail aliases. An outstanding reference about this support is the *Help for UNIX System Administrators* series published by O'Reilly & Associates, Inc. The *sendmail* book in this series, by Bryan Costales with Eric Allman and Neil Rickert (ISBN 1-56592-056-2), provides useful information about aliases and sendmail rules.

Step 2

The second step also has two parts. Part 1 configures the domain so that mail, in the form userid@domain, arrives at the host you chose earlier. Part 2 instructs the sendmail daemon running on the chosen host to recognize the domain name by its host name.

The Internet uses Domain Name Services (DNS) to resolve host names to Internet Protocol (IP) addresses. You need to provide an IP address for your domain name, and it must be the same as the host name you chose earlier. While other methods may exist, I use the Internet (**IN**) address (**A**) and mail exchange (**MX**) statements.

In part 1, using our fictional domain, we equate **os2warp.com** to **ns.os2warp.com.** Since **ns.os2warp.com** has an IP address of **9.227.13.35**, we add the statements shown in Figure 7 to the **named.dom** and **named.rev** configuration files, respectively.

In the book series *Help for UNIX System Administrators,* the *DNS and BIND* book, by Paul Albitz and Cricket Liu (ISBN 1-56592-010-4), provides useful information about DNS.

Part 2 of this step instructs the sendmail daemon to recognize the host name by its domain name. You need to modify the configuration file that your sendmail daemon is using. The default is send-mail.cf. Within rule set three (S3), the last rule (R) needs to be (with appropriate commenting) as shown in Figure 8.

Note that two tab characters must go between **R$+<@$D>** and **$@$1<@LOCAL.D>**. Tab characters are extremely important. You must use an editor that retains the tabs instead of converting them to blanks. An example of an appropriate editor is the OS/2 system editor (E.EXE).

```
Add to the named.dom file:

os2warp.com.              86400    IN   A     9.227.13.35
                                   IN   MX   50ns.os2warp.com.

Add to the named.rev file:

35          IN   PTR   os2rus.com.
```
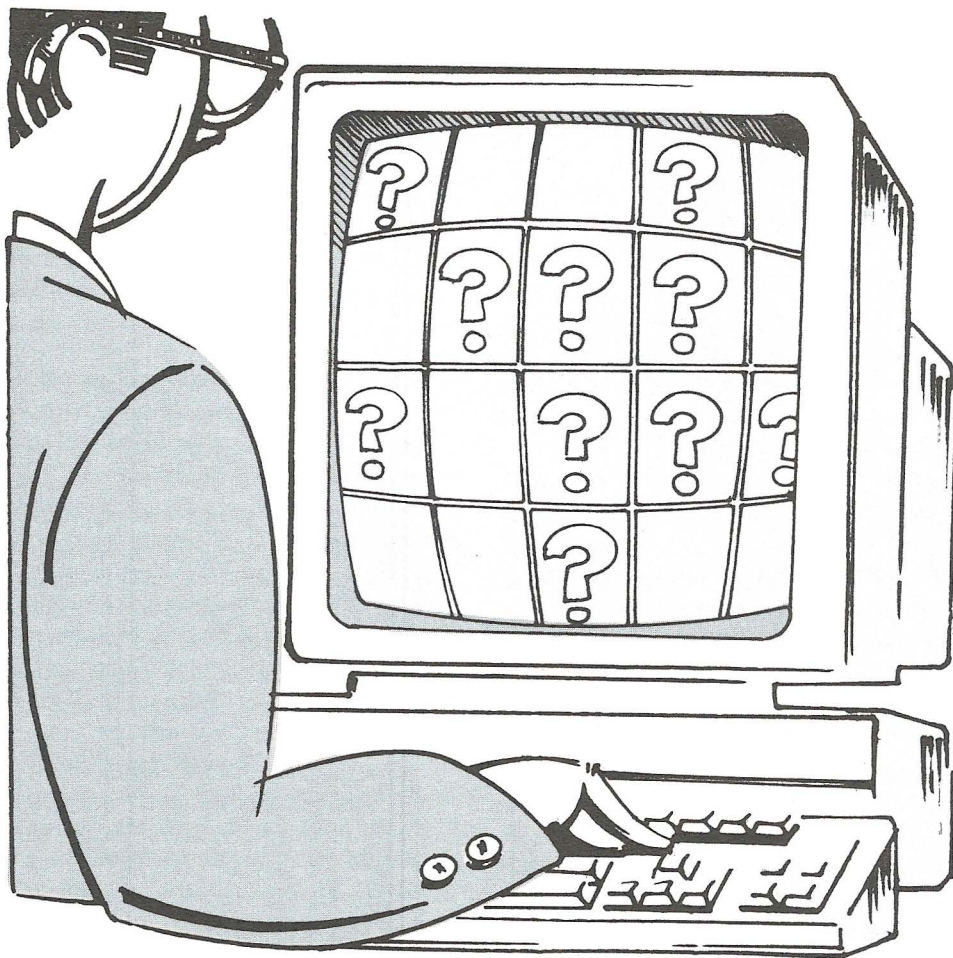
Figure 7. Statements to Add to Configuration Files

```
#
#   Recognize this workstation/host as local by its domain
#   name
#
R$+<@$D>  (tab) (tab)  $@$1<@LOCAL.D>
```

Figure 8. Telling Sendmail Daemon to Recognize Doamin name

Step 3

The third step may have two parts or only one, depending upon your level of TCP/IP.

The sendmail.cf file shipped with OS/2 Warp Connect includes the line

```
OAc:\mptn\etc\aliases
```

where `c:\mptn\etc` may be different from host to host. It should be the directory path where the active sendmail configuration file resides. In other versions of TCP/IP, this line exists, but ships as a comment. This line configures the sendmail daemon with the alias's file location.

Note: There are three types of aliases: userid, files, and programs. The sendmail daemon does support userid aliases in sendmail 1.13.2 level and above. It does not support writing to a file (aliasing a userid to a file). And official support does not exist for programs.

Finally, you'll need to create an aliases file. Using our example, the `os2warp.com` domain's sendmail aliases file takes the form shown in Figure 9.

In Figure 9, a userid on the left is an alias, and ends with a colon. For our purposes, these userids are the external userids (userid@domain). They also could be a real alias, for example, `support`.

The userids on the right are where the mail is to go (the *internal* or *real* address). There may be multiple userids on the right. For supporting the e-mail form userid@domain, you need only one userid on the right for each alias.

(I would like to thank Gunars Ziedins, developer of sendmail at the IBM T. J. Watson Research Center, for his review of this answer.)

```
# Mandatory aliases.
postmaster: postmaster@sneakers.os2warp.com
MAILER-DAEMON: postmaster@sneakers.os2warp.com


#
#   Userids and aliases on the rose.os2warp.com machine
#
#   NOTE:  All userids and aliases must be UNIQUE not only
#          at rose but THROUGHOUT the domain os2warp.com
#
juanita:    juanita@rose.os2warp.com
jcm:        juanita@rose.os2warp.com


#
#   Userids and aliases on the sneakers.os2warp.com machine
#
#   NOTE:  All userids and aliases must be UNIQUE not only
#          at sneakers but THROUGHOUT the domain os2warp.com
#
bgm:                    bgm@sneakers.os2warp.com
bert:                   bert@sneakers.os2warp.com


#
#   Userids and aliases for users outside of the os2warp.com
#   but who will look as through they belong within the
#   domain
#
#   NOTE:  All userids and aliases must be UNIQUE not only
#          at sneakers but THROUGHOUT the domain os2warp.com
#
myg:                    markg@emi.net
```

Figure 9. Aliases File

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OS/2 Fonts

Cliff Cullum
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Fonts – collections of characters drawn with distinctive styles – are a resource that OS/2 gives its users for powerful text display and printing. This article covers the basic varieties of fonts available in OS/2, the ins and outs of how these fonts are supported in OS/2, and some practical tips for making your font usage more convenient. Along the way, it pays special attention to the places where you can easily be stymied by "font gotchas."

The subject of OS/2 fonts can be introduced in a couple of ways:

(1) The OS/2 user is provided with a powerful platform to display and print text in a dazzling variety of ways. All that is required is that the user master the subject of fonts. Or,

(2) The OS/2 user who wants to make use of OS/2's powerful text display and print capabilities must first grapple with the complex, often bewildering subject of fonts.

While both statements are true, unfortunately it is too often the latter that represents reality. This article attempts to clarify the world of OS/2 fonts.

Font Types: A Font Is Not a Font Is Not a Font

A big part of the difficulty in dealing with fonts is that there isn't just one type of font. Instead, there are two major classes of fonts, and then there are subclasses within these, all of which have important differences in the way they are used in OS/2.

Bitmap Fonts: The first major class of fonts is *bitmap* fonts. In a bitmap font, each character is represented by a rectangular array of picture elements (pixels).
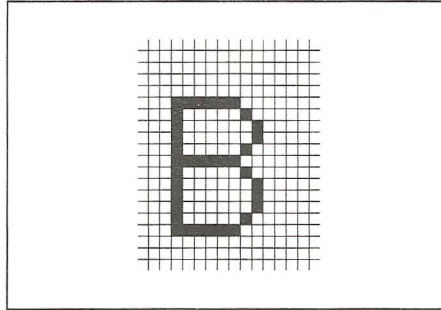

Figure 1. 12-Point Helv Font at 640x480 Resolution

Some of these pixels are black, and others are white (other colors are not relevant to this discussion, so we'll stick with just black and white).

A typical bitmap of a character is shown in Figure 1, which displays the character 'B' in 12-point Helv, one of the bitmap fonts that comes with OS/2. In Figure 1, each square represents a pixel. A pixel is the way that objects are displayed on a screen, and in almost all cases it is also the way that objects are ultimately drawn by a printer. Therefore, a bitmap font is a very natural way to represent characters. Indeed, for the ultimate fidelity in rendering a character, a bitmap font can't be surpassed, because the font designer can directly specify the color of every pixel.

Character sizes are traditionally specified in *points*. A point is a printer's measure approximately equal to 1/72 of an inch. The point size of a font is roughly equal to the vertical distance from the top of the tallest ascender (the part of a lowercase letter that sticks up above the rest of the text, as in an "h" or "d") to the bottom of the lowest descender (the part of a lowercase letter that sticks below the text, as in a "g" or "y"). Different fonts can have dramatically different-sized characters for the same nominal point size, depending on the size of their ascenders and descenders.

The problem that arises with bitmap fonts is that the drawing in Figure 1 depicts the character 'B' in only one size –
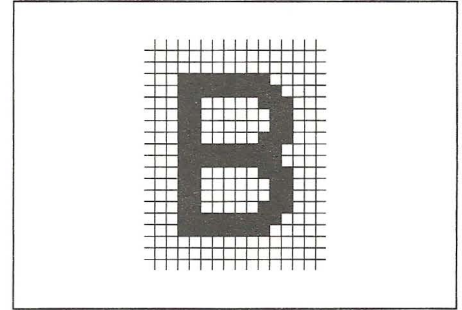
Figure 2. 14-Point Helv Font at 640x480 Resolution

12 points. The rendering of the character 'B' in Figure 1 doesn't tell us how to draw a 'B' in 14-point Helv. To do that, the font designer must provide another bitmap, containing the number of pixels required to draw the 'B' at a 14-point size, as shown in Figure 2.

In all, the designer needs to provide a separate bitmap for each character and each point size that the font can render. Most OS/2 bitmap fonts come in point sizes of 8, 10, 12, 14, 18, and 24 points, so there must be six different drawings for every character. What do you do if you want a size other than the ones supplied? Basically, you can't get it.

The complexity is actually much greater. On a display, the number of pixels per inch actually displayed on the monitor screen depends on two parameters.

First, there is the total number of pixels that the display adapter/driver combination can provide, e.g., 640x480 or 1024x768. (Numbers such as 640x480 are traditionally called *resolution*, but the display adapter actually controls the total number of pixels, not the resolution.)

Second, there is the actual size of the monitor screen (15 inches, 17 inches, etc.). A bitmap character that is 20 pixels high looks smaller when displayed at 1024x768 resolution than it does at 640x480 resolution on the same-size monitor, because the higher total

Figure 3. 12-Point Helv Font at 1024x768 Resolution
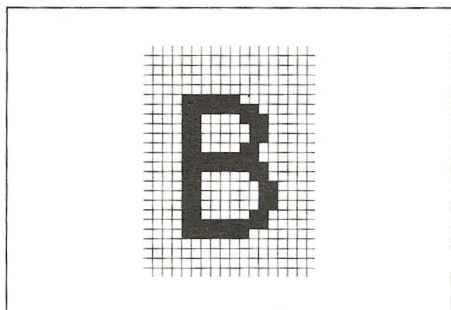
Figure 4. Helvetica Outline Font

Figure 5. 24-Point Helvetica at 1024x768 Resolution

number of pixels displayed reduces the pixel spacing. Similarly, for a given display adapter resolution, say 1024x768, the 20-pixel-high character looks larger on a 19-inch monitor than on a 15-inch monitor, because the pixels are spread out over a larger-size screen.

So, to do a proper job of displaying characters, we must also have bitmaps that correspond to different display resolutions and screen sizes. For example, whereas Figure 1 illustrates the character 'B' in 12-point Helv at a resolution of 640x480 pixels, Figure 3 shows the 'B', in the same 12-point Helv, as it is drawn on the same monitor at 1024x768 resolution.

A complete set of renderings for a font, therefore, requires a rendering for each point size, at each display resolution, and for each monitor size. At some point, the designer must say "no more" if the complexity is to be managed.

What is typically done in OS/2 is to provide the six point sizes in two different resolutions, roughly corresponding to 640x480 and 1024x768 displays, and let the other resolutions and different monitor sizes use one of these two. Even with this compromise, the size of the resulting font file is very large (for example, the bitmap HELV.FON file is 207 Kbytes).

Notice that we have so far restricted the discussion to displaying characters on the screen. The whole scenario has to be
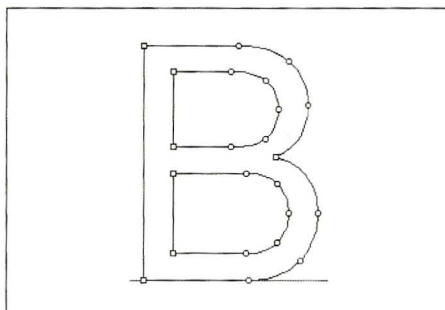
repeated if we want to be able to print these characters at the far higher resolutions that are available with printers.

OS/2 takes the easy way out, by limiting the use of bitmap fonts to displays only. For printing, another type of font – the Type 1 font discussed later – is substituted for the bitmap font.

Outline Fonts: There is another way to draw characters that removes the difficulties associated with bitmap fonts (while substituting a few problems of its own), and greatly expands the ability to use fonts.

An *outline* font uses mathematical equations to draw a character, representing it as a series of connected curves that describe the outline of the character. An example of an outline font is shown in Figure 4, where our familiar 'B' is represented in the Helvetica outline font that comes with OS/2 (Helv and Helvetica are the bitmap and outline representations, respectively, of the same typeface).

In Figure 4, the character 'B' is represented by a series of curves connecting a set of points (nodes) in a connect-the-dots style of drawing. No pixel grid is shown, because none is needed. Instead, when the time comes to draw the character, either on a display or on a printer, the computer adapts the outline to the appropriate size on a grid of pixels, then draws the outline and "colors" the pixels
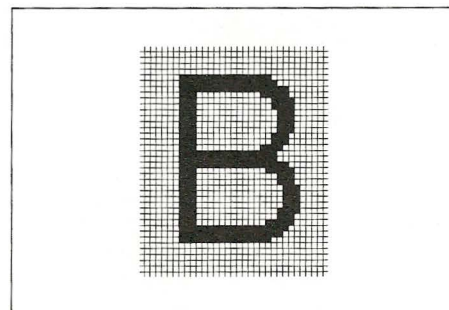
that fall inside the outline, as shown in Figure 5.

Other sizes of the same character – for example, a 1024x768 display, a 300 pixels-per-inch printer, or *any other size* – can all be generated from the one mathematical description, because outline fonts are *scalable*. Drawings of outline fonts can be scaled to any point size (although typographers will shudder at the thought – it is more complicated than this, so don't repeat this to your desktop publishing guru). With outline fonts, not only can you have fonts that are 48 or 72 or 96 points in size, you can also have 9.375 points if you need it. One mathematical description of each character in the font is sufficient, resulting in a font resource that takes up much less storage while providing infinitely more capability.

If outline fonts are as good as they sound, why bother with bitmap fonts at all?

For one thing, it takes a good deal of computing power to translate these mathematical descriptions to the bitmap images that are ultimately displayed. This makes rendering outline fonts slower, and much more resource-intensive.

Second, Figure 5 was purposely drawn showing a bitmap translation (called *rasterization*) of the outline at a large point size so that it would contain many pixels. If instead we try to do the same

Figure 6. 10-Point Helvetica at 1024x768 Resolution

Figure 7. 10-Point Helv at 1024x768 Resolution

transformation for a small point size on a lower-resolution display, it wouldn't be nearly as obvious which pixels to color black. Most pixels would be neither wholly inside nor wholly outside the outline. It is not easy to write a program to decide which of the partially covered pixels should be made black in order to give a pleasing and accurate rendition of the character under such circumstances.
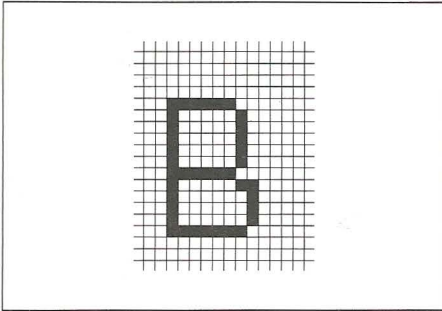
Figure 6 contains a rendering of the 'B' in 10-point Helvetica on a 1024x768 display, and Figure 7 renders the 'B' in 10-point Helv on the same display. 10-point characters are relatively small, and Figures 6 and 7 show that, for small characters or low-resolution displays, bitmap fonts are usually noticeably better-looking.

Fonts That Come with OS/2

Now that we have described the two generic types of fonts available in OS/2, we're ready to move to the specifics of the fonts supported by OS/2.

OS/2 Bitmap Fonts: OS/2 comes with the set of bitmap fonts shown in Figure 8. These fonts provide a basic stable of fonts for displaying characters on the screen. These fonts include:

- *Serif* fonts (serifs are the little extensions drawn on the tips of letters like the 'l' and the capital 'T') and *sans serif* fonts (no serifs).

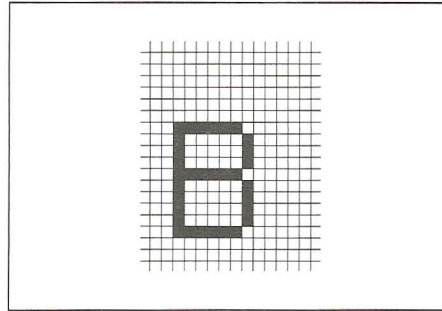- *Monospace* fonts (all characters are the same width) and *proportional*

fonts (each character has its own width, so that the overall type looks uniform and pleasing to the eye).

These fonts are supplied only as regular everyday characters. The OS/2 Presentation Manager simulates the following additional styles by thickening or slanting the characters when drawing them on the screen:

- **bold** style (wider, darker strokes)

- *Italic* style (slanted characters)

- The combination of the two, ***bold Italic***

Given the limitation of bitmap fonts, it is unlikely that either IBM or other vendors will significantly expand this set.

There is a separate, incompatible set of bitmap fonts for using Windows applications with OS/2. These fonts either

come with OS/2 (as they do in OS/2 2.x and in OS/2 Warp Version 3 with WIN-OS/2), or come as part of the separate Windows package (as in the cases of OS/2 for Windows and OS/2 Warp Version 3). In both cases, OS/2 is aware of and uses these fonts when a Windows application expects them.

Both the OS/2 bitmap fonts and the Windows bitmap fonts use the same FON extension for their font files, and they both provide the common fonts like Helv and Courier, so it can be difficult to tell which font file is which. The simplest way to tell which bitmap fonts belong to which environment is to look at where the font files are kept. The OS/2 bitmap fonts are found either in \OS2\DLL or in \PSFONTS, while the Windows bitmap fonts are in \WINDOWS\SYSTEM (or \WINOS2\SYSTEM).

Adobe Type 1 Fonts (ATM fonts):
The core of OS/2's font capability is the support for a specific kind of outline font known as a *Type 1* font. This outline font format was originally developed by Adobe Systems, Inc. in conjunction with their PostScript page-description language for printing on PostScript printers, and later extended via Adobe Type Manager (ATM) to permit use of the fonts with displays and printing on non-PostScript printers. Because Adobe Type Manager is where most users encounter Type 1 fonts, these

Font Name	Font Type	Contained in File	Directory Location
Courier	Monospace, Serif	COURIER.FON	\OS2\DLL
Helv	Proportional, Sans Serif	HELV.FON	\OS2\DLL
System Monospace	Monospace, Sans Serif	SYSMONO.FON	\OS2\DLL
System Proportional	Proportional, Serif	DSPRES.DLL*	\OS2\DLL
Tms Rmn	Proportional, Serif	TIMES.FON	\OS2\DLL

*DSPRES.DLL also contains other system fonts, called VIO fonts, which are the fonts used in an OS/2 or DOS command line session. We do not discuss these fonts here, but the interested user can read about them in the book *OS/2 Unleashed*.

Figure 8. Bitmap Fonts in OS/2

Font Name	Font Type	Contained in File	Directory Location
Courier	Monospace, Serif	COUR.PFB and COUR.OFM	\PSFONTS
Courier Bold		COURB.PFB, .OFM	\PSFONTS
Courier Italic		COURI.PFB, .OFM	\PSFONTS
Courier Bold Italic		COURBI.PFB, .OFM	\PSFONTS
Helvetica	Proportional, Sans Serif	HELV.PFB, .OFM	\PSFONTS
Helvetica Bold		HELVB.PFB, .OFM	\PSFONTS
Helvetica Italic		HELVI.PFB, .OFM	\PSFONTS
Helvetica Bold Italic		HELVBI.PFB, .OFM	\PSFONTS
Times New Roman	Proportional, Serif	TNR.PFB, .OFM	\PSFONTS
Times New Roman Bold		TNRB.PFB, .OFM	\PSFONTS
Times New Roman Italic		TNRI.PFB, .OFM	\PSFONTS
Times New Roman Bold Italic		TNRBI.PFB, .OFM	\PSFONTS
Symbol Set	Symbols, Greek Letters	SYMB.PFB, .OFM	\PSFONTS

Figure 9. Type 1 Fonts in OS/2

fonts have also become known as *ATM* fonts.

Adobe Type Manager is built into the OS/2 operating system for use with OS/2 programs. For Windows programs, a separate copy of Adobe Type Manager for Windows is installed with the WIN-OS/2 support in OS/2, so the same fonts can also be used in Windows. (It is the same font, even though different font metric files are used. The character drawings are contained in the PFB file, which is used in both implementations of Adobe Type Manager, and the font metrics files differ primarily in format rather than information content.)

It is interesting (and seldom remarked) that IBM has chosen to supply a copy of ATM for Windows as part of the OS/2 package, even for the OS/2 versions that come without Windows. This package, which Windows users must purchase separately, makes OS/2's Type 1 fonts more valuable by making them usable in Windows as well. This is another way that OS/2 provides added value for the Windows user.

Type 1 fonts are the overwhelming choice of typesetting professionals; thousands of fonts are available from many vendors, and new fonts are created on a continuing basis.

Historically, Type 1 fonts have been expensive, costing $100 or more for a single font family consisting of the regular, bold, italic, and bold italic styles of the font. The cost of a font is partly a reflection of the quality of the font design, which is a difficult and demanding art. Be careful when buying inexpensive fonts; you may get what you pay for.

Nevertheless, there are some inexpensive, high-quality Type 1 fonts available from reputable vendors. This is partly due to the competition from TrueType fonts, another outline-font format discussed later. One of the best buys is the Bitstream 500-Font CD-ROM for Windows, which despite its title is suitable for use in OS/2 as well as Windows. It offers 500 high-quality fonts in both Type 1 and TrueType format, and can be purchased for about $30. Other font CD-ROMs are available as well. Fonts can also be purchased individually from companies that commission original font

designs, like Adobe and Monotype, or from font resellers like Font Haus.

Figure 9 lists the basic set of Type 1 fonts in OS/2.

TrueType Fonts: In the late 1980s, Microsoft and Apple introduced a competing outline font format called *TrueType*. While they are based on the same general concepts as Type 1 fonts, the two formats are incompatible. The differences are not limited to matters such as file format; they extend to things as basic as the mathematical formulas used to draw the character outlines.

Many TrueType fonts have appeared on the market at very low prices. However, in spite of their popularity among casual Windows users, TrueType fonts have made very little headway among desktop publishing professionals, and Type 1 fonts continue to be the format supported most widely across different platforms.

OS/2 supports TrueType fonts in Windows applications, but IBM has not announced any plans to provide TrueType support for native OS/2 applications. Given the recent competitive prices for Type 1 fonts, and the availability of font-conversion programs that convert between the two formats, it is not clear that there is a strong requirement to provide TrueType support in OS/2 (although owners of large TrueType libraries will probably disagree).

Summary of Fonts: To summarize, there are four different, incompatible types of fonts supported by OS/2:

- OS/2 bitmap fonts, for OS/2 applications only

- Windows bitmap fonts, for Windows applications only

- Type 1 (ATM) fonts, for both OS/2 and Windows applications

- TrueType fonts, for Windows applications only

Depending on which applications you run, you may have to deal with all four flavors at one time or another.

Font Files: What Kind of Font Do I Have? One way to distinguish the different kinds of fonts is by the extensions of the font files.

Most bitmap fonts come in files that have the extension FON. Unfortunately, this is true for both OS/2 and Windows bitmap fonts, so the only way to tell them apart is by the directory in which they reside, as noted in Figure 8.

For outline fonts, life is easier. Type 1 fonts come with two or three (but sometimes four or five) files for each font. The basic font file has the extension PFB, and contains all the instructions for actually drawing the characters. In addition, there is always a font metrics file whose extension is of the form *FM. This file contains information about the widths of the characters, and other useful information for use in placing the characters when drawing them. The *FM extension is different in different circumstances. (We'll come back to this in a minute.)

Finally, TrueType fonts have files with the extension TTF. When a TrueType font is installed in Windows, an extra file with the extension FOT is created.

The Saga of Type 1 Font Metrics Files: The basic Type 1 font metrics file has the extension AFM, and is an ASCII file. Curious users may want to browse it to get a feel for the kinds of information contained. Much of it is undecipherable without a guide, but some things, such as how the font name is stored, are clear.

The AFM form of the font metrics file is the "universal" form, meaning that it is the one accepted across all environments. If you buy a font directly from Adobe, it comes with an AFM file. However, a more compact and efficient form of the font metric information can be ob-

tained using a binary format for storing this information, and both OS/2 and Windows take advantage of this.

In OS/2, when a font is installed from the PFB and AFM files, a binary font metrics file with the extension OFM is created. In Windows, when a font is installed, a binary font metrics file with the extension PFM is created. (More precisely, when installing a Type 1 font in Windows from the PFB and AFM file, it is necessary to also have a third file with the extension INF. Vendors who ship fonts with PFB and AFM files always include the INF file as well).

In both OS/2 and Windows, the AFM file is no longer needed once the OFM or PFM file is created. Font installation programs typically do not copy the AFM file to the user's hard-disk drive when installing fonts from diskette, and the Type 1 fonts that come with OS/2 have only the OFM and PFB files.

Converting Font Metrics Files – The Case of the Missing AFM File: Unfortunately, the AFM/OFM/PFM font metric file alternatives lead to some potential problems for OS/2 users. Some vendors aiming solely at the Windows market ship fonts with just the PFB and PFM files, making the font unusable in OS/2 unless you can obtain or create an AFM file. It is bad enough that you cannot use these fonts; to make it worse, when you try to install these fonts in OS/2, they don't even show up as available, since the OS/2 font installer looks only for AFM or OFM files. If you hear someone wail "OS/2 can't see my fonts" – our first "font gotcha" – the chances are very high that it is because the fonts have only PFM files.

Once you discover that you are missing AFM files, there are several recourses available to you:

- You can look back at the source of your font files. If they came on diskette or CD-ROM, the AFM files may be there rather than on your hard-disk

drive. Look closely, because they may be in another directory, or, in the case of at least one vendor, packed in a compressed format that you will discover only by reading the documentation that comes with the fonts.

- You can try calling the vendor. Some, but not all, vendors provide AFM files if you call.

- You can look in various on-line sources. On CompuServe, for example, there is a large collection of AFM files in the DTPFORUM library. The problem with these on-line sources is that they often don't have AFM files for the most recently released fonts, but it is worth a try nonetheless.

If you can't acquire the AFM files, the next option is to create them. There are at least three options available:

(1) Look on your favorite online source of OS/2 programs for a free PFM-to-AFM conversion program (on CompuServe, it is PFMAFM.ZIP in OS2USER Lib 4) that creates an AFM file from a PFM file. This isn't a fully satisfactory solution, because the PFM file does not contain some of the information needed to fully construct the AFM file. However, the author gives instructions for dealing with this, and many people have found this a satisfactory solution.

(2) Look in the same places for a shareware program called WREFONT (you may find REFONT instead, in which case you can get WREFONT by registering REFONT). This program does many font conversions, including building AFM files. For the most recent version, the shareware registration fee was $24.

(3) Get a commercial font-editing program that does many things, including allowing you to create your own fonts. Most of these programs also do font conversions, including building the missing AFM files. The least expensive of these programs at this time appears to be
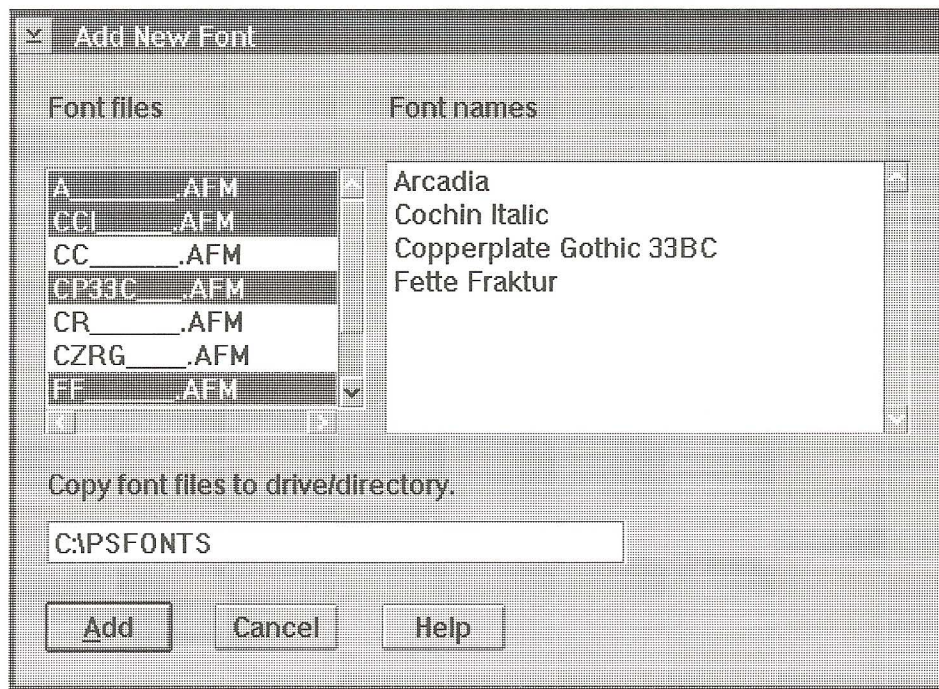
Figure 10. OS/2 Font Palette "Add New Font" Dialog

The next step is to specify the directory where the font files are located. The important piece of information here is that, for Type 1 fonts, the Font Palette is looking for an AFM or OFM file. Once you specify the directory, the Font Palette builds a list of all the fonts for which it finds one of these files, as shown in Figure 10.

Note: Be very patient here if you have pointed to a directory on a font CD-ROM. It can take the Font Palette several minutes to build its list when there is a large number of fonts in the directory. More than one user has concluded that the system is hung and has given up before this process completes.

If you are a Windows convert, it is here that you can get the nasty surprise of the Font Palette not "seeing" any of your Type 1 fonts, because you have only the PFM form of the font metrics file.

With the list of AFM/OFM files in hand, you can highlight the fonts to be installed, then click on the Add button to proceed with the installation.

It is at this point that the next "gotcha" can appear. A message box may appear that says:

```
Cannot copy fontname.AFM to
this folder. Make sure that
there is space available on
the disk, the drive is
ready, and the file exists
on %0. Then retry (PMV2024).
```

This sounds like there is a problem copying the AFM file to the font directory (most likely \PSFONTS). You check all the things that the message says to check – whether your hard-disk is full, whether there is a problem with the hard-disk drive not being ready, and whether the AFM file exists – but there seems to be no problem. So what's wrong?

The answer is that the Font Palette did not find the font PFB file in the same directory as the AFM file, a requirement

FontMonger, a Windows program that can generally be purchased via mail order for around $89.

Buying a font-editing program like FontMonger is significantly more expensive than options (1) and (2), but a font-editing program provides a great deal more function, including the ability to map some of the hard-to-access characters (like eastern European characters) into positions where you can use them without having to wrestle with code-page changes that your application may or may not support.

If all of the above choices seem too daunting or too expensive for you, keep in mind those low-priced CD-ROMs. It may be simpler to just start over with a set of fonts that come with all the required font files "out-of-the-box."

Installing Fonts in OS/2 and Windows

Now that we know what kinds of fonts we are likely to run into in OS/2, how do we find out which fonts are installed? More importantly, how do we install new ones if we acquire them? From this point on, we concentrate on Type 1 fonts, since that is the kind you will most likely want to install.

Installing Fonts in OS/2: The OS/2 Font Palette: OS/2 has one interface for dealing with fonts, whether they are Type 1 fonts or bitmap fonts. That interface is the OS/2 Font Palette in the System Setup folder.

When you initially open the Font Palette, you are presented with a display of eight fonts that you can drag-and-drop on various Desktop objects to change their fonts. You also see no obvious way to install a new font.

The somewhat unintuitive answer is that you first have to edit one of these fonts, either by clicking the Edit button in the Font Palette, or by double-clicking on one of the fonts. The next dialog allows you to choose which font will appear in this position in the Font Palette, and this is where you find the Add button that allows you to install a font.

that OS/2 places on Type 1 fonts. It is probably just a mistake in the message – which should have pointed to the PFB file – but it has dumbfounded more than one user who has come to OS/2 from DOS and/or Windows with a set of fonts in a main directory containing the PFB files and with a series of subdirectories labeled \AFM, \PFM, and \INF containing the relevant other files for the fonts.

If you run into this message, copy your AFM files to the PFB directory, and point to this directory when installing the fonts. (Once you do this, you can probably safely delete the \AFM directory.)

So far, I have not found any program that requires the AFM files to be located in an \AFM subdirectory. For fonts shipped by Adobe, AFM files come packaged on diskette in the same directory as the PFB files, and this is an arrangement that any program attempting to install the fonts is used to seeing.

Installing Fonts in Windows: Type 1 fonts are installed in Windows through the ATM Control Panel. The process for installing fonts using the ATM Control Panel is similar to that described for the OS/2 Font Palette, so we won't go through the details.

When installing Type 1 fonts in Windows, the most common problems are:

(1) Trying to install the fonts using the Windows Control Panel's Fonts dialog instead of the ATM Control Panel. The Windows Control Panel is used to install bitmap fonts and TrueType fonts, which are the only types of fonts directly supported by Windows. Type 1 fonts are only supported in Windows as an add-on, so a separate font installation mechanism is needed.

(2) Selecting the wrong font directory. ATM is looking for either the PFM or INF files for the fonts. You will need to point ATM to a directory containing one or the other of these files. ATM won't find any fonts to install if the directory you point to contains only PFB and/or AFM files.

(3) A new setting in OS/2 Warp's WIN-OS/2 Settings. This setting allows the user to turn ATM for Windows on or off in individual Windows sessions. Turning this Win-ATM setting to Off when a Windows program doesn't use Type 1 fonts saves memory and improves performance, so this can be a useful setting.

Unfortunately, the default for this setting is Off. As a result, you may find, after installing OS/2 Warp, that your ATM fonts don't work in Windows.

If this happens to you, check the ATM Control Panel, and see if a version number appears in the panel alongside the word "Version" or if it says `Inactive`. If the latter is the case, it is likely that you haven't turned the Win-ATM setting to On. You will find this setting in OS/2 in the Windows Setup object in your System Setup folder. Turn it on there, and also turn it on for each of the Windows programs that already have desktop objects (those that were migrated during installation).

If this doesn't fix the problem, ask for help via the OS/2 Support Line or CompuServe. There are other situations that can also lead to ATM showing as `Inactive`, so your problem may be more complicated.

Common Scenarios

At this point, you should now have the basic tools to understand which fonts you have or want to get, and know how to install them in OS/2. (We haven't really described how to install TrueType or bitmap fonts, because as an OS/2 user you are unlikely to want or need them.) The rest of this article focuses on some common scenarios that arise when you begin to exercise these skills.

Where Do Font Files Have to Live? If you install a font in OS/2 using the Font Palette, chances are the font files ended up in the \PSFONTS directory in your OS/2 partition. This is the default location presented by the Font Palette, but for many users it is not a desirable outcome. This may be because your OS/2 partition is already pretty full, and font files can be quite large (typically 50 to 75 KB per font). Or it may be your desire, shared by this author, to keep everything out of the OS/2 partition except for the things that the OS/2 installation puts there. Or it just may be that these font files are already located on your hard disk somewhere else, and you want to avoid duplication (see the next topic). For these reasons, the question of whether the font files can be located somewhere else is a common one.

The good news is, the answer is yes. OS/2 keeps a record in the OS2.INI file of the fully qualified path to each font installed in the system. Consequently, you can even put each font into a completely different directory, and OS/2 will happily use them.

The trick is to intervene at the right point in the Font Palette installation process. That point comes after you have selected the fonts to be installed (as shown in Figure 10), but before you click on the Add button. Note in Figure 10 the entry field labeled " Copy font files to drive/directory." By default, that field already points to \PSFONTS, but you can change it to point to any fully qualified path. If your fonts are already somewhere on your hard-disk drive, modify the entry to point to the directory where the font files are located. The Font Palette then creates the OFM file, adds it into your specified directory, and does not move any of your files. The only annoyance here is that you must remember to do this every time you install a font, since the Font Palette always defaults to the \PSFONTS directory.
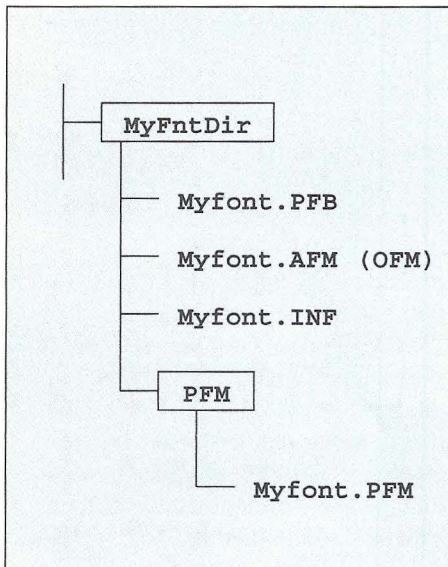
Figure 11. Recommended Font Directory Structure

Sharing Font Files between OS/2 and Windows: One of the most common questions from many users coming from Windows is whether they need to have duplicate copies of their font files in order to use them in both OS/2 and Windows.

To avoid duplicate copies of the font files, it is necessary to:

(1) Establish a directory structure containing the Type 1 font files that both OS/2 and Windows can use in dealing with fonts, and

(2) Tell both the OS/2 Font Palette and the ATM Control Panel to install the font files to this common directory structure.

The first requirement is accomplished by the directory structure shown in Figure 11. It lets you use your Type 1 fonts in both OS/2 and Windows without having to duplicate any font files. If you have INF files, they can either be put into the same directory as the PFB and AFM files, or they can be put into an INF subdirectory similar to the way the PFM files are arranged.

To deal with the second requirement, we need to tell both the OS/2 Font Palette and the ATM Control Panel to install fonts into the directory structure we have created.

We have already explained how to tell the OS/2 Font Palette to use a different font-file location, so we just need to direct it to copy the font files to the directory we have created above for holding the PFB, AFM, and OFM files.

A similar approach can be taken with the ATM Control Panel when installing Type 1 fonts for use in Windows. Just change the entry in "Target directory for PostScript outline fonts" on the Add Fonts panel (shown in Figure 12) to point to the same directory, containing the PFB files, that you used for the OS/2 font installation. Notice that the next entry in the Add Fonts panel, labeled "Target directory for font metrics files," changes in tandem to point to the PFM subdirectory under your chosen directory, which is just what we have set up in our directory structure.

This recommended directory structure can reside anywhere on any of your hard-disk drives. Furthermore, you can have as many of these directory structures as makes organizational sense to you. (My approach is to keep my fonts separated by their source. All the fonts that came with my PostScript printer are in one place; the fonts that I purchased directly from Adobe are in another; the fonts I downloaded from CompuServe are in a third; and so on.) You just need to remember to make the proper changes in the directory entries of the Font Palette and ATM Control Panel during installation of the fonts.

Moving Font Files after They Are Installed: So now you've got your fonts installed, but you don't have the font files where you want them, or maybe you just added a new hard disk and your drive letters have changed. What, if anything, must you do so that your fonts still work after the files have been moved?

The answer is (1) you definitely have to do something, and (2) you can get your-
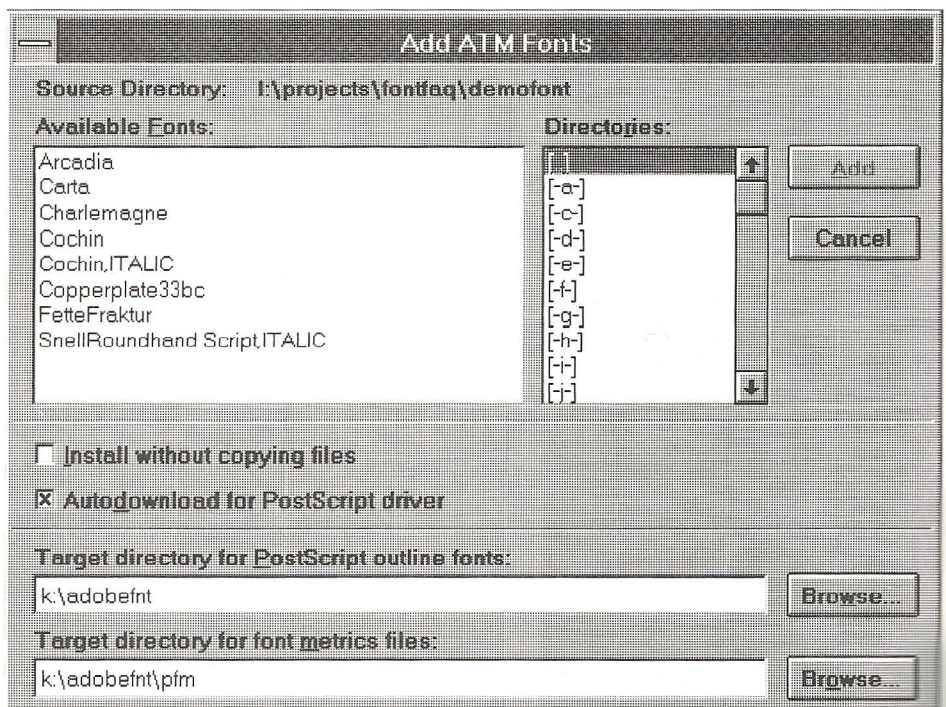

Figure 12. ATM Control Panel "Add ATM Font" Dialog

self in a pickle if you don't do things in the right sequence.

Remember we said that OS/2 records the location of each installed font individually in OS2.INI. An example of this information is shown in Figure 13, as displayed by IniMaint, an OS/2 INI file editor. OS/2 reads this information during bootup, and accesses these files to get the information it needs to work with the fonts. If you simply move the files without updating this information, OS/2 is unable to find them, so you won't have your fonts available to use.

If that were the only problem, it would be bad enough, but in versions of OS/2 prior to Warp a quirk of the Font Palette makes it worse.

It turns out that there are two different lists of the installed fonts kept by OS/2. The one in OS2.INI is the permanent list; as we have noted, OS/2 consults it when booting up to determine which fonts to load. But when OS/2 loads these fonts, it creates a second list in memory that it uses for quick access. All is well as long as these two lists are identical. But, as we have noted, if you have moved the font files, OS/2 won't be able to load the fonts during bootup, so your moved fonts won't be in the list in memory, even though they are still in the list in OS2.INI.

Your logical reaction to seeing that the fonts are not loaded is to reinstall them from their new location. When you do this, the Font Palette consults the list in OS2.INI and sees that the fonts are already registered there, so it informs you that the fonts are already installed and refuses to reinstall them.

Naturally, your next thought is to uninstall the fonts to remove the OS2.INI entries so you can reinstall them properly from their new location. With OS/2 Warp, this is all you have to do. Unfortunately, for OS/2 2.x users, life isn't that simple. When you try to uninstall the
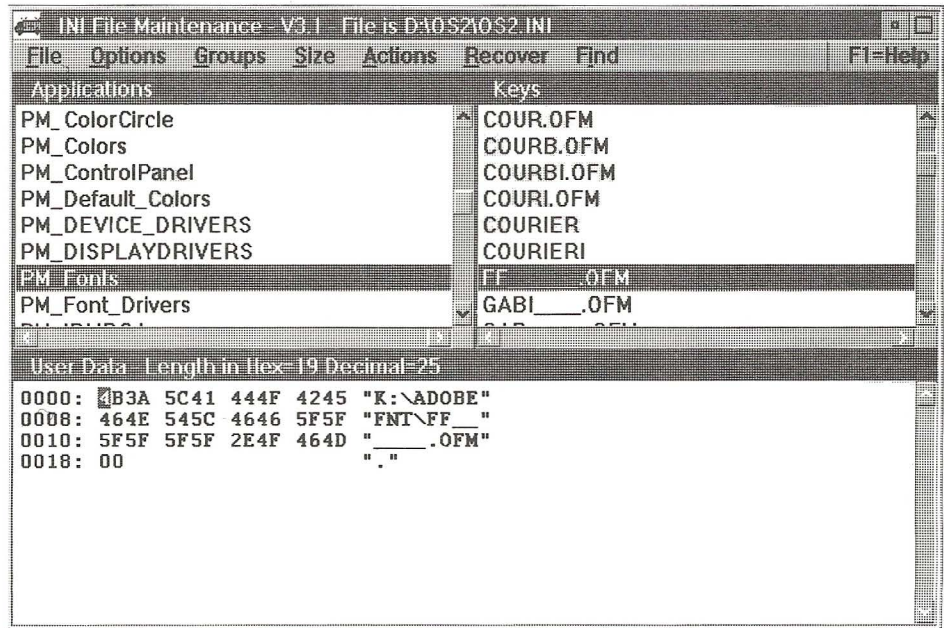

Figure 13. OS2.INI Font Entries

fonts, this time the Font Palette consults the list in memory, which doesn't contain the fonts. So the list of fonts it puts up for you to uninstall doesn't contain the fonts you are looking for. Gotcha!

At this point, the only solutions are:

(1) Temporarily copy the font files back to the old location; reboot OS/2 so it can now find the font files; uninstall the fonts; and finally, reinstall them from their new location. Or,

(2) Get an INI file editor and zap the entries in OS2.INI that point to the old location (not for the faint of heart).

A better answer is to avoid the problem in the first place by following a three-step approach to moving your fonts: First, uninstall all of the affected fonts. Second, move the font files. Finally, reinstall the fonts from their new location.

Although we won't go into the details, Windows keeps similar records internally about where to find the font files, so you will need to use the same three-step approach there as well.

A Final "Font Gotcha": We'll conclude with one final place where the unwary can stumble using fonts in OS/2.

There are times when you may want to uninstall a font from OS/2. We have just described one example. When you do this, you need to be especially wary using the Font Palette. The process for uninstalling fonts using the Font Palette – the button to uninstall a font is labelled **Delete...** , which ought to set off appropriate warning bells – leads through a succession of message boxes that ask you to make decisions.

The first message, shown in Figure 14, says "All fonts in the fontname.OFM file will be deleted. Are you sure you want to delete it?" The use of the plural "fonts" may seem confusing if you have only selected one font to delete, but you can safely ignore this. The message is really asking whether you want to uninstall the font you have selected. Choose Yes, rather than the default of No.

The real problem to watch out for is the next message, shown in Figure 15. It says "Delete font file fontname.OFM from drive directory ...?" and offers Yes

as the default. This sounds a lot like the last question, which talked about fonts in the same fontname.OFM file and asked if you wanted to delete it. The second question may sound like a repetition of the last question, and the answer there was Yes, so it is very tempting to answer Yes here also. If you do – gotcha!

This time you are being asked if you want to delete the OFM file itself, not just uninstall the font. If you answer Yes, there goes your OFM file from your hard-disk drive!

OK, you say, but you can always have OS/2 recreate it the next time you install the font from the PFB and AFM files. Gotcha again!

While it never was mentioned in any of the messages, the Font Palette erased your PFB file at the same time it erased the OFM file. If you were smart and arranged your directory structure so you could share the font files with Windows, don't expect to be able to use the font in Windows, even though you still have it installed there. That PFB file is sort of important, because it contains all the in-

formation about how to draw the characters. And you'd better have a separate copy of that PFB file if you ever want to use that font again.

What you should do instead is answer No to this second message, in which case the Font Palette uninstalls the font (removes the entries in its in-memory list and in OS2.INI) without touching the font files.

If this all seems a little complicated to remember, one aid is to remember to choose the *opposite* of the default answer in each case.

OS/2 Fonts: A Powerful Tool

This article has tried to arm you with some basic knowledge about fonts, as well as a few tips and warnings. However, there is much that the article has not covered. A good supplement to this article is the Fonts chapter in *OS/2 Unleashed,* in either the OS/2 2.11 or the OS/2 Warp edition.

Once you begin to explore the world of fonts in OS/2, you will find you have a very powerful tool to improve your documents and presentations. However,
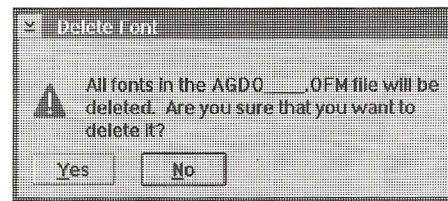

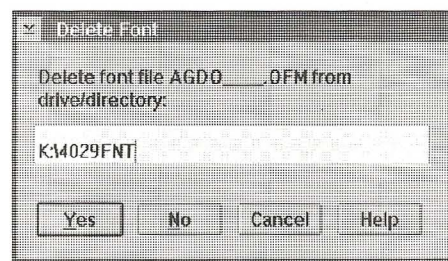Figure 14. Font Palette "Delete Font" Message 1

Figure 15. Font Palette "Delete Font" Message 2

a final warning is in order: Fonts can be intoxicating, so beware of becoming a "font junkie." Warning signs are the inability to pass up an offer to buy more fonts, or when your font collection zooms past 500 fonts and you see no reason to stop. At this point you are in need of further assistance, in the form of a Font Manager ... but that's a topic for another article.

Cliff Cullum is an independent software developer, developing and marketing the only independent OS/2 font manager as a shareware program. He retired from IBM in 1993 after a career including 17 years in hardware management at IBM Research in Yorktown Heights and 10 years at IBM CHQ in Armonk, where his jobs included Director of Technical Strategy Development, Operations, and Chief of Staff to the IBM Chief Scientist. Cliff has long been interested in typesetting and fonts, and was an early user of desktop publishing systems and of OS/2. He combined a retirement goal to "learn to program at a serious level" with his interests in fonts and OS/2 to produce a font-management program for OS/2, and is the self-appointed font expert in OS/2 forums on CompuServe. Cliff can be reached via Internet at 75013.1701@compuserve.com.

FontFolder Font Management Program

If you only have a few ATM fonts, then it makes sense to use the OS/2 Font Palette and install them all in OS/2. But what do you do if you have 200 fonts or, heaven forbid, you own one of the font CD-ROMs that contain 2000 fonts? If you install all these fonts at once in OS/2, you will find that it takes dramatically longer to boot OS/2, and your font menus will be so long you will find it almost impossible to find anything.

The answer is, you need a font manager, a program that allows you to keep track of all your fonts without having to install them. It provides a way to conveniently browse through your fonts, install a font when you need it, and uninstall it when you are done, without having to go through the multiple-menu steps of the Font Palette.

FontFolder, my $20 shareware font manager for OS/2, brings these capabilities to OS/2. It provides a font browser, single-click font installation and removal, and the ability to build a collection of fonts, called a *fontpack,* that allows all the fonts in the collection to be installed with one click. FontFolder also supports using fonts directly from a CD-ROM, so you don't need to take up hard-disk space with font files that you aren't using.

If your font collection grows to the point that you need a better way to manage your fonts, check out FontFolder. You can find it on CompuServe in OS2BVEN, Library 1, as FNTFnn.ZIP (where *nn* is the most recent version, currently FNTF12.ZIP). It also can be found on many OS/2 bulletin boards. – *Cliff Cullum*

Guru in Training

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(Reprinted with permission from extended attributes, *newsletter of The Phoenix OS/2 Society, Inc., February and March 1995 issues, and updated for this article.)*

Making Room for OS/2

Welcome to "Guru in Training," a column dedicated to helping new (and old) users of OS/2. This month we will be discussing different options and techniques useful in configuring OS/2 on your hard drive subsystem.

If you are currently a DOS and/or Windows user, have no fear! OS/2 provides several interesting ways for you to keep your current operating system, and add to its capabilities while you explore the power of OS/2. Perhaps you are sold on the power of OS/2, but wish a little flexibility to allow your machine to boot up many different operating systems (different versions of OS/2, DOS, and even Windows 95).

AC/DC (Dual Boot and Boot Manager):

OS/2 is a supercharged operating system for your PC, capable of replacing DOS and providing greater performance and better overall system usability. But, what if you are cautious and wish to experiment with OS/2 slowly? Wouldn't it be great if you could use your system as currently configured (perhaps running DOS/Windows) and then flip some magical switch and boot up OS/2 without disturbing your other operating system? Well, IBM has provided us with two different and capable mechanisms to perform this magic!

Dual Boot is the capability to boot up either DOS or OS/2, both of which are installed on your C: drive. Boot Man-

Drive	Name	Type	File System	Size
C:	DOS/Win	Primary	FAT	200 MB
D:	OS/2Warp	Extended Logical	HPFS	90 MB
E:	OS/2data	Extended Logical	HPFS	150 MB
F:	Test	Extended Logical	HPFS	90 MB

Figure 1. Sample Configuration of a 540 MB Hard Disk

ager is a little more advanced capability, which allows you to boot up different operating systems that reside on different partitions of your hard drive. Dual Boot is automatically set up for you if you select the OS/2 Easy Install option and DOS currently exists on your C: drive. Boot Manager is only available (for the brave few) using the Advanced Installation option, and may require FDISK to partition your hard drive (more on FDISK later).

Picky, Picky, Picky: Which one should you use, Dual Boot or Boot Manager? Next you'll be asking me the true meaning of life. (I don't know, but I think it involves multitasking.) To make this critical decision, you must ask yourself: Do I need the power (and complication) of Boot Manager? Chances are, you will opt for the more basic Dual Boot.

Dual Boot is easy and automatic, and lets you switch between DOS and OS/2 in a fairly simple way. When set to boot DOS, your computer will start up the DOS operating system whenever you boot it. To switch to OS/2, you execute the DOS command:

```
C:\OS2\BOOT  /OS2
```

When your system restarts, OS/2 will be started instead of DOS. In order to switch back to DOS, you double-click on the Dual Boot object in the Command Prompts folder in the OS/2 System folder. Note that Dual Boot works in DOS or OS/2 mode until changed to the other mode. Fairly simple, eh?

Well, hold on for the alternative. Boot Manager is an advanced facility which allows you to split (partition) your hard drive into "logical" bootable operating systems. DOS expects to boot from your C: drive; in fact, with Boot Manager, C: must be set up as your Primary drive. OS/2, on the other hand, is capable of booting from a drive other than C:. This is referred to as an *extended logical* drive. You may, in fact, wish to configure multiple extended logical drives on your hard drive.

FDISK: The FDISK program in OS/2 is used to divide or partition a hard drive into multiple distinct segments. Boot Manager and FDISK work together to bring about the second form of OS/2 hard-drive configuration magic.

Let's try to cut through the technobabble with an example. Suppose you wish to configure your 540 MB hard drive with the operating systems shown in Figure 1. In Figure 1, "Drive" is the hard-drive disk designation, "Name" is an eight-character name you assign (the eight-character limit is imposed by Boot Manager), "Type" is either primary or extended logical, FAT" is the DOS-based directory structure, "HPFS" is the OS/2 High Performance File System, and "Size" is current space allocated to this partition.

Boot Manager is more than capable of allowing you to boot DOS from your C: drive, OS/2 from your D: drive, and a test operating system from your F: drive (such as a new version of OS/2). Partition E: in the example is not meant to

be bootable; it is used to hold OS/2 programs and data files.

Don't worry if the idea of multiple logical hard drive partitions scares you. Simply go with the Easy Install option to allow OS/2 to share your C: drive with DOS. This is a simple but effective way to return your investment in DOS and/or Windows and slowly get more comfortable with OS/2. After your comfort level is increased, you may be ready to set up an advanced hard drive configuration similar to the one outlined above. Next month we will be exploring the procedure in Boot Manager to accomplish this.

Boot Manager is King: Boot Manager, although harder to plan and set up, provides great advantages over Dual Boot. But, power comes with a price tag. In order to use Boot Manager to control which logical hard drive is started, your hard drive must be partitioned. Partitioning using FDISK effectively destroys any and all information that is currently on your hard drive. You have a reliable, up-to-date backup, don't you? This is the scariest part of the Boot Manager scenario: running FDISK, and wiping clean your hard-drive data.

But, Boot Manager is indeed elegant. Every time you boot your system, Boot Manager gives you a "choice" screen similar to the partition diagram in Figure 1. Choose the operating system you wish booted, and thereafter the boot process appears as normal. A timer can even be set up, so an unattended bootup will start your preferred operating system.

Plan ahead to set up a hard drive configuration you can call your own. Dual Boot is simple and effective. Boot Manager is more time-consuming and advanced, but very powerful. Next month, join us for some hints and tips on FDISK and setting up a Boot Manager configuration that will allow for another operating system or install of the next version of OS/2.

File Systems and Boot Manager

Now we will delve further into configuring OS/2 on your hard drive subsystem, exploring Boot Manager and its power to run multiple operating systems. Hang on tight, this ain't no Dual Boot Easy Install. Powerful, but confusing – welcome to the big leagues!

FAT versus HPFS: As we have discussed, OS/2 is a supercharged operating system for your PC, capable of replacing DOS and providing greater performance and better overall system usability.

> *Boot Manager,*
> *although harder to plan*
> *and set up,*
> *provides great advantages*
> *over Dual Boot*

In order to remain compatible with DOS, IBM built the FAT (file allocation table) file system into OS/2, but also included an expandable facility called Installable File Systems (IFS). This allows IBM and other developers to write alternate file systems to augment and enhance FAT.

What is a file system used for? It is the basic "logical" structure on your disks. It contains information about your disk files, using a method similar to a file cabinet, which allocates finite, reusable space. The file system represents the structure and file information contained within a single partition.

FORMAT is the command to prepare (or erase) a logical partition and to initialize the file system structure. FDISK is the command to manipulate partitions on your physical disk drive.

Included with OS/2 are a couple of optional installable file systems: HPFS (high performance file system) and CDFS (CD-ROM file system). One of these days, someone will write the Macintosh IFS so we can read and write Mac disks using OS/2.

HPFS was designed to handle large disks and large files, and to enhance the overall performance of the disk file system. Included at no extra charge is the ability to use long file names. For example, this article was written using the word processor Describe 5.0 and the descriptive (and somewhat long) filename:

OS2_guru_training_#03_Mar95_
File-Systems_and_Boot_Mgr.

If it were confined to the 8.3 standard for FAT file names, the article name might be OGT3FSBM.DES. Which name do you think more accurately represents the contents of the file?

HPFS is also designed to prevent disk fragmentation. The DOS FAT file system is famous for its perpetual need to be defragmented to keep performance running well.

If you are running Dual Boot, you don't have a choice – you must install OS/2 using FAT. But with Boot Manager, you can segregate DOS on FAT and install OS/2 on HPFS. But, what if you are cautious and want to proceed with OS/2 slowly? No problem! Don't be afraid that committing to HPFS will limit your ability to run DOS and/or Windows applications. OS/2 performs some really neat magic here, called *partitions*.

If you install OS/2 on drive D: using the HPFS file system, OS/2 will take advantage of the ability to use long file

names. For example, Warp 3.0 creates a folder (directory) in the root directory called "Maintenance Desktop." This folder, and its long filename, can only be seen from an OS/2 program.

DOS (and Windows) programs can read and write to HPFS disk volumes, because OS/2 "fakes out" DOS, making it believe it has access to a FAT volume. But DOS programs can only read and write to file names that conform to the FAT rules (8.3). Therefore, if you open a DOS window and look at the D: drive (by executing the DIR command), you will see all the files with names that are valid for DOS (8.3).

DOS programs function normally on HPFS volumes running on OS/2. The only restriction is that you cannot run low-level disk utilities such as SpinRite and Norton Utilities. These programs need to access the disk at a very low level, but OS/2 will not permit them to bypass the security built into OS/2.

HPFS requires more RAM (memory) than FAT. If you are running OS/2 Warp with less than 8 MB, stick with FAT (but consider more memory).

HPFS vs. FAT is like OS/2 vs. Windows. Once you experience the power of OS/2 and HPFS, you can't go back!

The Great Divider: Before we look at the details for creating partitions, let's consider the hard-drive partition layout in Figure 1. This layout is what we are aiming for.

FDISK is an OS/2 program (there is an FDISK program for DOS also, but use the OS/2 version) that is used to divide a hard drive into multiple partitions.

The best way to prepare your hard drive for a Boot Manager install is to run FDISK from your emergency boot floppy disks (your homework assignment number 1 should be to create these disks). Creating these disks is easy: Warp provides a program object in the

Figure 2. FDISK Showing a Single Existing Partition C:

Disk 1 2				
Partition Information				
Name	Status	Access	FS Type	MBytes
	Startable	C:Primary	FAT	540

Figure 3. FDISK Showing Partition C: Has Been Erased

Disk 1 2				
Partition Information				
Name	Status	Access	FS Type	MBytes
	None	: Pri/Log	Freespace	540

System Setup folder. For those of you not yet running Warp, simply use the first two disks of your installation set.

The FDISK program takes a little getting used to, but it is really not that bad. Besides, there's always F1 for help.

Let's suppose FDISK shows you the scenario in Figure 2, in which your system has two physical hard-disk drives ("Disk 1 2"), and hard drive 1 has a single partition of 540 MB, formatted as FAT.

Here comes the leap of faith: In order to re-partition this hard drive into C: (FAT), D: (HPFS), E: (HPFS), and F: (HPFS), you must delete your C: partition and then reallocate the partitions. Let me say again: *You must DELETE your C: partition.* FDISK is a dangerous program – do not use it unless you understand the consequences!

It is *absolutely imperative* that you back up all of your data from C: before running FDISK. Once a reliable backup has been secured (and perhaps verified), you may continue.

To navigate through FDISK, use the Tab, Enter, and arrow keys. The tab key switches between the top portion ("Disk 1 2" in Figure 2) and the bottom portion, where the partitions are listed.

Use the Tab key to select the C: partition, and press Enter to get the Options menu. "Delete partition" should be an available action; use the arrow key to select it, and press Enter to execute it. After that, what's left of your hard drive is shown in Figure 3.

Now is the time you finally get to set up Boot Manager. Select the 540 MB freespace, and press Enter. Choose the option to Install Boot Manager. This allocates a 1 MB partition that will be booted when your system is started.

Next, create the C: partition (choose Primary), and enter the desired size in megabytes. Choose to create it at the start of the freespace. Similarly, create partitions D:, E:, and F:, making sure you choose Extended Logical for the type. When completed, your partitions should look like the information in Figure 4 (numbers are approximate).

```
Disk 1 2

Partition Information
Name       Status         Access        FS Type       MBytes

           Startable      : Primary      BOOT MANAGER       1
None                      C: Primary     Unformatted      200
None                      D: Logical     Unformatted       90
None                      E: Logical     Unformatted      150
None                      F: Logical     Unformatted       90
```

Figure 4. FDISK Showing Four New Partitions Plus Boot Manager

```
Disk 1 2

Partition Information
Name       Status         Access        FS Type       MBytes

           Startable      : Primary      BOOT MANAGER       1
DOS/Win    Bootable       C: Primary     FAT              200
OS/2Warp   Bootable       D: Logical     HPFS              90
OS/2Data   None           E: Logical     HPFS             150
Test       Bootable       F: Logical     HPFS              90
```

Figure 5. FDISK Showing Names on Four Partitions

Figure 5 represents the final desired partition table, which supports DOS on C:, OS/2 on D:, OS/2 data on E: and OS/2 test on F:. In Figure 5, each partition has a name. The name is created by highlighting the partition, pressing Enter to get the Options menu, and selecting the option "Add to Boot Manager menu." The partition name appears as a partition "title" when the Boot Manager panel is displayed at system boot time.

Let's review the process for transforming your disk partitions:

- From your hard drive partitions, back up all data you want to keep.
- Run FDISK from your OS/2 emergency boot backup disks.

- Use Tab and arrow keys to select the proper disk (1 or 2).
- Use Tab to select C: partition, then press Enter for menu, and arrow keys for Delete.
- Press Enter for menu, then install Boot Manager.
- Use arrow keys to select Freespace, then press Enter for options menu.
- Create partition C: as Primary at the start of freespace.
- Similarly, create partitions D:, E:, and F: as Extended Logical (not Primary).
- Adjust partition sizes according to need (you can always delete a partition mistake).

Once FDISK partitioning is complete, save the results and exit. OS/2 must now be rebooted. Start again from your boot floppies, and format the partitions:

```
format c: /l
format d: /l /fs:hpfs
format e: /l /fs:hpfs
format f: /l /fs:hpfs
```

where /l (long format) is for OS/2 Warp only.

Boot Manager is now basically set up and ready for reinstall of DOS on C: and new install of OS/2 on D:.

Note: Some versions of Microsoft DOS and the new Windows 95 will appear to overlay Boot Manager. After installing one of these other operating systems, it will appear that all of your hard work setting up Boot Manager has been deleted. Have no fear! Your partitions are still there; the only difference is that the C: partition, rather than the Boot Manager partition, has been marked as startable. To rectify this, simply reboot from your OS/2 floppies, execute FDISK, delete Boot Manager, and then reinstall Boot Manager. This will make your OS/2 world well again.

The procedure given here is only a guideline; please modify it to suit your individual requirements.

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OS/2 Tips

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Alt+Tab	Switch among windows
Alt+Esc	Switch between windows and full-screen sessions
Alt+F7 or Alt+M	Move a window, very handy when windows get almost off the screen
F1	Context-sensitive (usually) help
Spacebar	Selects / deselects objects
Ctrl+ /	Selects all objects
Ctrl+ \	Deselects all objects
Alt	Brings up the system menu. Then: hitting C closes the window; hitting X maximizes the window; hitting N minimizes the window.

Figure 1. Some Key Combinations in OS/2

Mouse and Keyboard Tips

Mouse tip: If you hold the shift key down when you open an object (double-click mouse button 1), the parent folder closes as the child opens. If you hold the Alt key when you double-click on an object, the settings notebook for the object opens; and if you double-click on a blank spot on the desktop, the Launch-Pad pops up.

Key combinations: Figure 1 lists useful key combinations if you don't want to bounce between keyboard and mouse.

Backups

Make sure you archive your desktop after significant changes. Open the desktop settings notebook, go to the Archive page, and check the "Create archive at each system restart" box. This saves a copy of CONFIG.SYS and the desktop (OS2.INI, OS2SYS.INI, etc.) at bootup. Shut down and reboot. Open the settings notebook again and turn *off* the "Create archive at each system restart" check box. You can save three archived desktops plus the install version.

I also set the "Display recovery choices at each restart" option, with a five-second timeout. This is the same as hitting Alt+F1 when the little box is in the corner during startup. The five seconds gives me time to change the CONFIG.SYS or get an archive of my desktop during the bootup.

You can set up a multiple CONFIG.SYS menu to select the CONFIG.SYS to use at bootup time. First, *make a backup,*

then copy CONFIG.SYS to the drive:\os2\boot directory as CONFIG.A. Now, edit CONFIG.A to customize it. To be able to select CONFIG.A at the recovery choices menu, we need to edit the file ALTF1BOT.SCR, but it is read-only. This can be changed from the command line by typing

```
ATTRIB drive:\OS2\BOOT
    \ALTF1BOT.SCR-R
```

where `drive` is the OS/2 drive. With your favorite editor, add

```
A CONFIG.A (Use this version
    of CONFIG. for _____)
```

Fill in the blanks with the purpose of CONFIG.A. You now have two CONFIG.SYS files, the original and CONFIG.A, in the \OS2\BOOT directory. At the Alt+F1 menu, hit Esc to use the original, or hit A to use the new one.

Do this for each variation of CONFIG.SYS that you want. You can have a bunch of CONFIG.SYS files, one for each letter of the alphabet, with a few exceptions.

Want to test it? Add a line to the bottom of CONFIG.A:

```
DEVICE=GOBBLEDYGOOK.SYS
```

and enter A at the Alt+F1 menu. During bootup, you will get an error on that statement. Hit enter, and the system will

boot OK. This tells you that your new CONFIG.A was selected.

Another utility creates a set of system diskettes that you can boot from if you destroy your CONFIG.SYS and didn't save a recent backup. It creates three diskettes. You could just boot the first and second installation diskettes instead. I really make use of the install diskettes when I trash stuff. Remember, you have to use a non-PM editor, like TEDIT, and you can find CHKDSK on diskette 2, or copy it from the OS2 directory on the hard disk.

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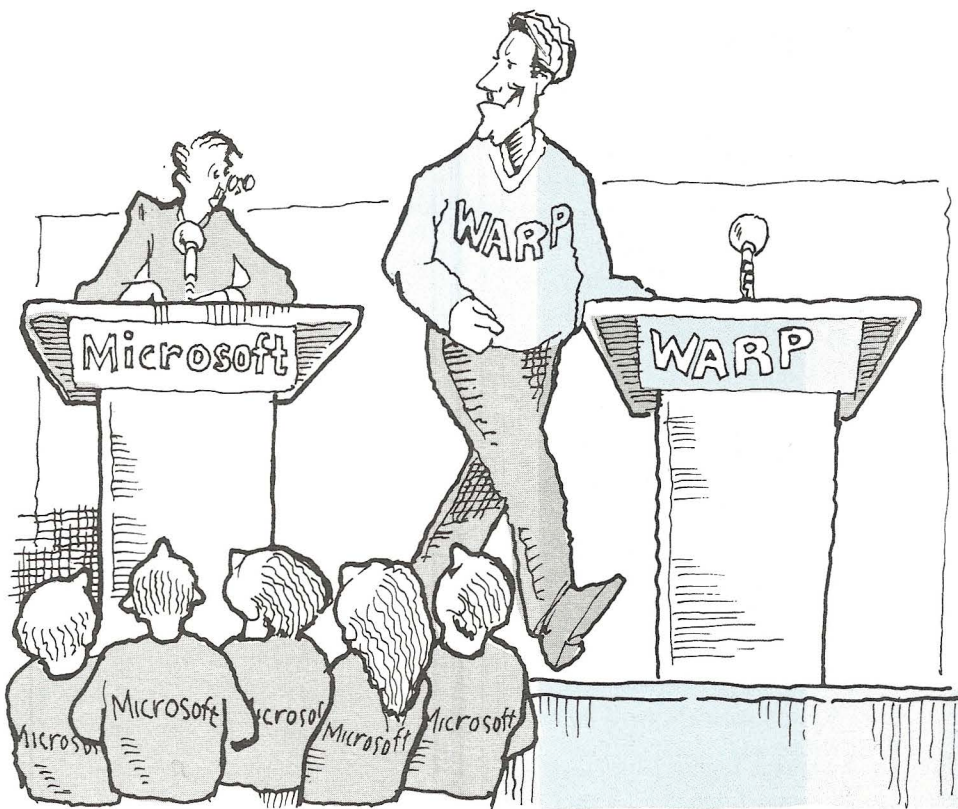
OS/2 Warp Connect vs. Windows Family

PSP Marketing Strategies
IBM Corporation

This article explains the benefits of OS/2 Warp and the total IBM product line over Microsoft Windows NT. Its main focus is Microsoft Windows NT Workstation and NT Server, compared with IBM OS/2 Warp Connect and the OS/2 Warp family of products. Also, the integration of OS/2 Warp with LAN Server, and their relationships with other IBM software products – System-View, DB2, WorkGroup, AS/400, etc. – are compared against Microsoft's Windows NT and BackOffice.

Microsoft has increased the marketing hype for Windows NT in corporate accounts in recent months, most likely because Windows 95 has been delayed until at least August, and because the Windows 95 beta program has exposed several significant weaknesses in Windows 95:

- Multitasking is cooperative rather than preemptive when 16-bit applications are running.

- 16-bit code, carried over from current DOS and Windows products, may create an instability exposure.

- Multithreading problems hang the system when multiple multithreaded applications are multitasked and resources are depleted.

- Lack of underlying object technology impacts usability, as evidenced in the potential for shortcuts to break when files are moved, and in inconsistent use of drag-and-drop.

This situation comes at a time when Microsoft is reaching for credibility in the enterprise. Microsoft's thrust into the enterprise marketplace is shifting back to Windows NT. In addition, by attempting to redefine the complex world of client/server into "Office/BackOffice" terminology, Microsoft is trying to leverage their dominance in the desktop productivity suite marketplace to gain entry into the server market, where to date they have been largely unsuccessful.

BackOffice is a merely a marketing rebundling of Microsoft's server products. The BackOffice products are totally NT-centric, running on Windows NT only. Client support is focused on Windows platforms, with minimal support for other platforms.

The products included in BackOffice are:

- SNA Server

- SQL Server

- System Management Server

- Microsoft Mail (to be replaced with Exchange by year-end 1995 or in 1996)

- NT Server

Microsoft solutions are proprietary, with the APIs controlled by Microsoft. At the Microsoft Tech Ed in New Orleans in March 1995, the *old* definition of open systems was read from the Oxford Dictionary of Computing as "Any system in which the components conform to nonproprietary standards, rather than to the standards of a specific supplier of hardware or software." This definition was declared dead at the conference! The Microsoft speaker proclaimed that "DeFacto is DeStandard."

Windows NT 3.5 has been more successful for Microsoft than the initial release, but it still has technical issues – the lack of scalability beyond four microprocessors, and memory cache limitations. The RAM requirement for NT is higher than that of OS/2, and there are few NT native applications – less than half the number of OS/2 native applications.

In contrast to Microsoft, IBM has a comprehensive set of client/server offerings, allowing complete solutions to be

Some of the information in this article concerns future products, or future releases of current, commercially available products. Discussion of Windows 95 is based on information that Microsoft has made public as of the date of publication of this paper (June 1995), or information in the public trade press, and is subject to change. IBM's future products and their performance, functions and availability are based upon IBM's intent, and are subject to change.

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tailored specifically for each corporate environment. IBM's middleware strategy is to have pervasive middleware everywhere, including on both IBM and non-IBM clients and servers.

Unlike the Windows family, the OS/2 Warp family of products provides a consistent user interface across laptops, desktops, LAN servers, and symmetrical multiprocessing (SMP) systems. This consistency decreases training and support costs while enabling maximum productivity. A single, consistent application programming interface (API) set across the entire operating system family simplifies application development, thus reducing costs. And all OS/2 and LAN Server releases have been upwardly compatible, offering investment protection for existing applications.

IBM actively participates in numerous open-standards organizations and supports their open standards, contributing to IBM's any-client-to-any-server strategy.

Advantages of OS/2 Warp and the IBM Family

OS/2 Warp Connect, LAN Server, and the IBM scalable servers provide a breadth of solutions that is unmatched in the industry. IBM has superior solutions for today's heterogeneous, open computing environment. Among the benefits are the following:

- Unbeatable value: OS/2 Warp Connect has all of the connectivity features plus the BonusPak of productivity applications plus Internet access.

- Pervasive middleware: DB2, CICS, MQ Series, SystemView, DCE, Communications, IBM Workgroup, ImagePlus, etc. offer total solutions from laptops to parallel mainframes, and on both IBM and non-IBM clients and servers.

- Investment protection: You can continue to run your existing DOS, Windows, and OS/2 applications more productively in OS/2 Warp's crash-protected environment.

- Openness: IBM's support for industry standards provides excellent multivendor interoperability and flexibility when choosing solutions.

- Scalability: Consistency in user interface and APIs across the OS/2 Warp family of products minimizes training costs and maximize productivity.

- World-wide technical support: IBM software products are supported by IBM, not vended out to be performed by other companies.

In addition, IBM is:

- The world's largest computer company
- The world's largest services provider
- The world's largest software vendor
- The world's leading investor in research and development
- The world's leading patent holder for 1994

- The world's leading global customer network provider
- The world's leading supplier of computer products
- A truly global company that understands our customers' enterprise requirements

In summary, IBM and Microsoft have two completely different approaches to client/server computing. Microsoft's strategy is a Windows-centric strategy, adhering predominantly to Microsoft proprietary standards. IBM's solutions are pervasive middleware and groupware on all relevant client/server platforms, adhering to open standards.

Microsoft Windows NT Evolution

Released in 1993 and true to its name, Windows New Technology (NT) broke with tradition, because compatibility with existing software was not the major design goal. Reliability, scalability, and portability across hardware platforms were the highest-priority design goals, with security running close behind.

But Windows NT required excessive system resources, and was therefore relegated to servers and high-end desktops. By Microsoft's standards, NT was not considered a marketing success, with sales figures at approximately 300,000 during the first year, missing the 1 million predicted by Bill Gates.

In October 1994, Microsoft introduced version 3.5 of Windows NT, the second release of the operating system. Windows NT 3.5 is packaged as two separate products, Windows NT Workstation 3.5 (formerly known simply as Windows NT) and Windows NT Server 3.5 (formerly known as Windows NT Advanced Server, or NTAS).

Microsoft recently declared 1 million NT licenses had been shipped, with approximately 80 percent being NT Workstation licenses; however, IDC,

Dataquest, and META Group analysts all put the figure in the 600,000 to 650,000 range. The result has therefore been incrementally more successful for Microsoft.

The technical abilities of NT, coupled with the lateness and deficiencies of Windows 95, have resulted in a major Microsoft marketing thrust into the corporate world, led by Windows NT.

Cairo and Beyond

Microsoft has publicly discussed the follow-on product to NT, code named Cairo, for the last year. Among the functions that have been declared for Cairo are:

- Plug-and-play
- Distributed OLE
- Distributed object-oriented file system
- Support for Win32c APIs (currently Windows 95 only)
- Global/enterprise directory

Cairo had been specified as the converged release in which Microsoft will merge existing 16-bit (Windows 3.x), hybrid 16/32-bit (Windows 95), and 32-bit (NT) operating systems into one full 32-bit platform.

To make their Windows 95 deadline, Microsoft has reportedly shifted resources away from Cairo, pushing its delivery date out. The latest estimated dates for release of Cairo are very late 1996 or early 1997, although Microsoft has publicly announced that Cairo beta-testing will begin in 1Q96.

More recently, Microsoft representatives have declared the next release beyond Cairo as the converged release. In the interim, Microsoft has taken several steps toward the converged software platform, including:

- Announcing an interim common user interface in NT and Windows 95

- Requiring applications that receive a "Windows 95 Compatible" logo to also run on NT

In a May 5, 1995 press announcement, Microsoft announced plans for the future of object technology in their products, based on their current, proprietary Object Linking and Embedding (OLE) technology. Titled "OLE Enterprise Development Direction," the plan calls for OLE to be used for transaction management, database management, and other distributed environments.

> *"After examining Microsoft's plan for building distributed applications, I recommend the following: Bone up on OpenDoc and SOM/DSOM."*

Although Microsoft is beginning to acknowledge the pivotal role of distributed computing in the enterprise, their current OLE desktop environment lacks services, such as directory services, which a distributed object environment requires. And, using an incompatible emulation of one component of Open Software Foundation's (OSF) standard for distributed computing environment (DCE) – the remote procedure call (RPC) – to patch OLE's complex component model will not yield an industrial-strength scalable solution for the enterprise.

The lengthy Microsoft press release contained a six-step plan for an enterprise object plan, but did not contain a single product announcement or deliverable with a timeframe reference. Reporting about the announcement in their May 8,

1995 issue, *Network News* quoted several industry analysts who were disappointed by the lack of details and lengthy implementation timeframe. Among them was Aaron Zornes, vice president of application development strategies at META Group Inc., who said: "What's new? What's solid? This is a lecture in Transaction Processing Monitors 101." The same article referred to IBM's SOM, DSOM, and OpenDoc as alternatives that "already deliver, at least in beta, what Microsoft now only promises." In an editorial in the following week's edition of the same publication, John Gallant said: "After examining Microsoft's plan for building distributed applications, I recommend the following: Bone up on OpenDoc and SOM/DSOM."

Windows NT Product Description

The Windows NT Workstation and Server products have much in common. NT Server is a superset of NT Workstation, with server functions added. The key to the NT facilities is not necessarily robustness, but ease of use and a common look-and-feel across the desktop and server. For users and developers, the main elements of commonality include:

- Common user interface: Graphics User Interface (GUI), similar in appearance to Windows 3.1 (Program Manager, File Manager, etc.)
- Common API set: Win32, 32-bit
- Common tools: Software Developers Kit (SDK), Visual C++
- Common applications: MS Mail, TCP/IP, Schedule+, LAN Connectivity, Microsoft's RPC

Windows NT Workstation

Windows NT Workstation is a multitasking, multithreaded 32-bit operating system targeted at running engineering, financial analysis, and business-critical applications, and for software development. Features and functions include:

- Peer-to-peer networking (file and print sharing)
- Mail
- Client
- Group calendar scheduling - Schedule+
- NetWare client
- Claims of C2-certifiable security
- Performance monitor
- Motion Picture Experts Guild (MPEG) support
- Event logger
- Journaling file system
- Simple network management protocol (SNMP)
- OpenGL graphics
- Remote access to LAN
- Transmission Control Protocol/ Internet Protocol (TCP/IP)
  - Point-to-Point Protocol (PPP)
  - Windows Internet Name Service (WINS)
  - Dynamic Host Configuration Protocol (DHCP)
  - Serial Line Internet Protocol (SLIP) - available with NT Workstation for users who have SLIP servers; no SLIP server is provided with Windows NT Server
- Internet and Sequential Packet Exchange (IPX / SPX)
- Symmetrical Multiprocessing (SMP) support
- Unicode support

The workgroup functions included in NT Workstation allow sharing of information (for example, mail and calendar) *only* with users attached to the same server. For cross-server sharing, upgrades must be purchased, limiting the basic NT Workstation product's appeal to enterprises.

Windows NT Server

Windows NT Server 3.5 is Microsoft's primary server operating system, and represents the foundation for Microsoft's BackOffice suite of enterprise products. Windows NT Server includes all of the function in NT Workstation, plus the following server functions:

- File, print, and mail server
- Application server
- Communications support that includes TCP/IP, IPX/SPX, and NetBEUI
- Security administration
- Disk administration
- User administration
- Backup and restore
- Performance monitor
- Remote access services
- Disk mirroring and Redundant Array of Independent Disks (RAID) 5
- NetWare gateway
- Remote IPL (RIPL)

Hardware

The minimum recommended configuration for Windows NT Workstation is an Intel 486/66 processor or higher, 16 MB of memory, CD-ROM (recommended), one diskette drive, 90 MB of available disk space, VGA adapter, and network adapter card.

Although these resource requirements are lower than those of NT 3.1, they are still significantly higher than those of OS/2 Warp, with almost double the RAM requirements in most situations. One consultant predicted a stronger acceptance of NT on the desktop when NT's hardware requirements become available in systems costing less than $2,000.

At the time of this writing, Windows NT has released versions available for the following platforms:

- Intel x86 systems - 486 and Pentiums from a wide range of manufacturers
- Intel x86 symmetrical multiprocessing systems
- MIPS R4000 and R4400 systems
- DEC Alpha AXP systems

There is also a version of Windows NT for PowerPC in beta-test. While stating that portability across this range of platforms has made an excellent marketing point for Microsoft, IDC also says that more than 95 percent of Microsoft's NT sales have been on the Intel platform.

Points to consider about Windows NT on non-Intel platforms include:

- Since the vast majority of the early installations have been on the Intel platform, the other platforms have not had the real-world debugging that is needed with a new operating system.
- Platform-specific device drivers need to be implemented and tested to support unique hardware application layer (HAL) requirements.
- To support SMP machines, a different NT kernel is required. As a result, when a customer upgrades from a one-processor configuration to a two-processor configuration, the customer must reinstall NT and the associated system software components from the original CD.
- Much of NT Server's attraction is due to its similarity and commonality with the Windows desktop. While most Windows 3.1 products and applications will run (although slower) on an Intel-based NT system, the same cannot be said for the Alpha and MIPS platforms. The customer will need to determine what application support is available for these RISC platforms.

Comparing Strengths and Weaknesses

Let's take a closer look at some of the features of Windows NT so that its

strengths and weaknesses can be better understood and compared to those of OS/2 Warp.

User Interface

NT: The Windows NT user interface is a multithreaded version of the Windows 3.x GUI. Usability has become a major Windows problem. The reasons for the usability problems and confusion with the Windows 3.x GUI of NT are apparent when simple tasks like printing are attempted. Printers are configured using the Control Panel, the print characteristics are determined by the Print Setup option of an application's File menu, and spooling is controlled through the Print Manager.

Such usability problems have led to the development of a completely new Explorer interface for Windows 95. Until the availability of Explorer on NT, the usability problems that have plagued Windows 3.x will be a way of life for NT users.

Microsoft has recommended Windows 95 as their desktop operating system of choice where usability and ease of use are factors, thus acknowledging the weakness of Windows NT in this vital area.

OS/2 Warp: OS/2 Warp's object-oriented desktop, which won the CeBit design award at the world's largest computer show in Germany in April 1995, provides a single consistent user interface across the entire family of OS/2 Warp products. This consistency minimizes training time and maximizes productivity. OS/2 Warp's drag-and-drop printing provides for fast, efficient printing. The use of advanced user interface controls like containers – which are absent in NT – simplify application development and afford a cost savings.

Object Technology

Object technology provides a nontraditional, beneficial approach to application design and development. Among its advantages are:

- Higher-quality applications, built mostly from existing, proven components.

- Rapid prototyping and application development, with experienced object developers reducing the amount of code written by up to 95 percent. "Object-oriented development will allow us to build components, or objects, that we can reuse. I prefer to call it pro-use – short for profit from more use – to rapidly develop software that is platform-independent. Software development is the most expensive part," said Franz Muller, member of senior management, information technology development, Credit Suisse in Zurich.

- Flexibility provided by adding new objects without modifying the existing ones.

Object-oriented technology encompasses three characteristic features:

- *Encapsulation* - The process of grouping functions and data together into an object. The object is a seamless capsule that offers services with no visibility as to how those services are implemented. The objects can then be reused, reducing programming time and cost while increasing software quality, which in turn reduces support and maintenance costs.

- *Inheritance* - The process of evolving the existing object. Rather than starting from scratch to create each object, the programmer starts with an existing object, inherited from an object library, and then describes only the portion that is different. Without inheritance, each object is a free-standing unit developed from the ground up.

- *Polymorphism* – Adds flexibility by allowing values to have more than one type, to enable use in different contexts.

NT: Object-based technology, such as the programming language ADA, was common in 1980's programming. Microsoft's object technology – Visual Basic, OLE, and COM – is object-based rather than object-oriented. Also, Windows NT 3.5 supports OLE 2.0. Today, OLE supports encapsulation, but not inheritance or polymorphism, making it object-based but not object-oriented.

OLE is a Microsoft proprietary architecture. This enables Microsoft to decide which platforms will support OLE, and when. Contrary to Microsoft's claim of CORBA support for OLE, their programming model is their Common Object Model (COM) using CORBA as a transport, so COM must be supported on both ends of the pipe. A proprietary architecture on both ends of a standard architecture is a proprietary solution!

The current OLE 2.0 APIs have built-in, short-term limitations, such as lack of inheritance, that may force developers to continue to upgrade their applications as they move to a future distributed COM/OLE. The implication of Microsoft's control of the OLE APIs was very apparent in the industry uproar over the recent announcement of the merging of OLE and ODBC APIs. This constant churn creates development and maintenance expense that application developers cannot afford.

Even when the Windows 95 Explorer user interface is added to NT, the lack of an underlying object-oriented technology will remain a hindrance.

OS/2 Warp: IBM's System Object Model (SOM) technology lets users create interchangeable, reusable software components that are language-, tool-, and platform-independent. Developer toolkits are available for OS/2, AIX, and Windows.

The impact of object technology on both usability and user productivity is clearly demonstrated in the example in Figure 1, which involves the simple, common

task of sending a fax using OS/2 Warp's integrated BonusPak application on the Workplace Shell desktop.

Connectivity

NT: Windows NT 3.5 Workstation ships with a NetWare client that, while enabling connectivity to a NetWare LAN, lacks significant function required by users and administrators.

The use of login scripts, which are extremely important for NetWare administrators, is not supported by the NT-supplied requester. Many hours and hundreds of thousands of dollars have been invested by companies to get each user's login scripts to address their concerns appropriately – to provide the adequate level of security and the different choices that are necessary during server login. Microsoft considers all of this work to be irrelevant and wasted, because the Microsoft-supplied client does not support the login scripts in the NetWare bindery. With Windows NT, all of this work will have to be redone from scratch if you want to retain security for the network.

The NetWare 4.x Directory Services, which provide support for enterprise directories from your NetWare 4.x services, are not supported. Enterprise directories are very important for enterprise-wide systems management. This is a service provided in NetWare 4.x. The Microsoft-supplied NetWare client cannot support the NetWare 4.x Directory Services.

Novell has an NT Requester for NetWare currently in beta, targeted for availability in mid-1995. This requester can replace the one that ships with NT, and can give NT Workstation clients access to NetWare file and print services, and support for NetWare 4.1 and NetWare Directory Services. Obtaining this requester will add time and expense to the process of installing NT clients.

Windows NT Workstation	OS/2 Warp with BonusPak
1. Start application that created the document 2. Select File from pulldown menu 3. Select Open 4. Select Document 5. Click on OK 6. Wait for the document to open 7. Select File from pulldown menu 8. Select Printer Setup 9. Select the fax printer 10. Click on OK 11. Select File from pulldown menu 12. Select Print 13. Click on OK 14. Key in phone number and cover sheet information 15. Click on OK 16. Do other work while document is being faxed to your associate 17. When faxing is complete, close application menu	1. Open address book 2. Drag business cards onto document 3. Drag document to fax machine 4. Click on OK for cover sheet 5. Do other work while document is being faxed to your associate

Figure 1. Sending a Fax in Windows NT and in OS/2 Warp

OS/2 Warp Connect: In this, the industry's most network-savvy desktop, built-in LAN requestors seamlessly link desktop systems to each other and to all major network operating systems, including OS/2 LAN Server, Novell NetWare, NT Server, Lotus Notes, and a variety of Internet servers. Communications are supported via NetBIOS, TCP/IP, or IPX on Ethernet, Token Ring, and FDDI networks, eliminating the need to buy transports or client code when attaching to the industry's most popular servers.

OS/2 Warp Connect also supports LAN connections via infrared, cellular devices, and serial port connectivity. Remote LAN connectivity is supported by LAN Distance Remote, which is also included in OS/2 Warp Connect. Advanced network support features required by the enterprise will be available on a separate CD to be announced in mid-year.

Application Programming Interfaces (APIs)

NT: Windows NT introduced Microsoft's first 32-bit APIs – Win32. Shortly afterward, Win32s was introduced. Win32s provided the least common denominator for applications to run across Windows platforms, providing 32-bit file and disk access, but lacking any multithread support. In addition to the Win16 API set, which has 78 percent of the Windows market share, Windows 95 has introduced a third set of 32-bit APIs – Win32c. Not all Win32C APIs are supported in NT. Microsoft's "Windows 95 Compatible" logo program requires an application to run on both Windows NT and 95. Due to architectural differences, this requirement has been the source of significant consternation among ISVs writing Windows 95 applications.

Microsoft has a history of churn in its API definitions, as demonstrated by the following examples:

- Win16 / Win32 / Win32s / Win32c for operating system APIs.

- VBX to OCX for application development APIs.

- OLE 1.0 to OLE 2.0, which caused a virtual rewrite of OLE 1.0 applications. Next will be the distributed OLE in Cairo for compound document API.

- ODBC 1 to ODBC 2 for database access APIs.
- And now with a project code-named Nile, Microsoft is switching gears from ODBC to OLE as their primary database access API, with the new API set called OLE DB.

For instance, the Windows 95 user interface APIs are not yet supported under Windows NT.

OS/2 Warp Connect: The single 32-bit OS/2 API set across the entire OS/2 Warp family, from laptops to SMP servers, provides significant advantages to application developers. All OS/2 and OS/2 LAN Server releases have been upwardly compatible. (In fact, IBM's PCLP 1.0, which shipped in 1985, works with the currently shipping LAN Server 4.0 ten years later!) The advantage of having only one code base to maintain and support leads to significant cost savings. Additionally, IBM has outlined a comprehensive set of industry-standard, open APIs for client/server computing, as defined in IBM's Open Blueprint.

Memory Management

NT: NT's literature loudly proclaims that 2 GB of memory is assigned to each process, where a process is either a transaction or an application. What Microsoft doesn't mention is that only 256 MB is guaranteed to be available for that process. The remainder of the 2 GB is shared among all processes on that server.

In practice, this limitation has created a problem for large enterprise databases attempting to port to NT. When paging to disk is required, performance can lag to unacceptable levels. *Computer Reseller News* carried details of these limitations in a feature story in its January 30, 1995 issue, with the headline "Windows NT Performance Hits Wall In Enterprise Zone."

Symmetrical Multiprocessor (SMP) Support

NT: NT is architecturally designed to support 32-way multiprocessing, but is only shipping support for up to 4-way. In spite of NT's touted 32-way SMP support, reports of NT's inability to scale beyond four processors has received considerable press recently. As Microsoft continues to push into the enterprise arena, with NT as their operating system foundation, they are downplaying this roadblock, frequently blaming application developers in the face of mounting evidence to the contrary. High-end databases are common applications of the SMP systems, and are limited by NT's CPU scalability performance, as well as its memory and caching issues.

OS/2 for SMP is architected for 1,024 processors, and has been tested on systems with up to 256 processors.

Additional, little-known facts about NT's SMP support that affect the practical usage of NT on SMP systems include:

- NT's SMP support is not architected to dynamically assign processes to the available processors. Processes must be assigned to specific processors by the users.
- Only native 32-bit NT applications – no DOS or 16-bit Windows applications – can exploit NT on SMP.

OS/2 Warp: OS/2 for SMP protects your investment in your current applications by providing immediate perform-

ance gains to your DOS and Windows applications and even greater performance gains to multithreaded OS/2 programs when executed on multiprocessing systems.

OS/2 for SMP is architected for 1,024 processors, and has been tested on systems with up to 256 processors. Currently, one to sixteen 486 or Pentium processors are supported in a single system, which dynamically assigns available processors for maximum efficiency. OS/2 for SMP also supports systems that conform to Intel's Multiprocessor Specification (MPS) v1.1 and Intel's Advanced Programmable Interrupt Controller (APIC).

C2-Certifiable Security

Securing a network presents unique challenges and is significantly more difficult than securing a standalone system. The government-defined C2 level of security was designed for standalone environments, and a network extension is currently being defined by the federal government. No network operating system (NOS) has received C2 certification to date.

NT: Microsoft has applied for C2 certification for NT. If approved, the C2 compliance will be limited to networks that contain only NT servers and NT Workstation clients, and that utilize the NT file system (NTFS). This means that no DOS, Windows, or Windows 95 clients can be given access to the NT server. Accesses to File Access Table (FAT) or High Performance File System (HPFS) partitions are not useable either.

Positioning NT as an application server in a distributed environment pits the advantages versus the disadvantages of the security features. NT requires a password to be entered before re-establishing an outbound network connection. Following a reboot due to a power outage or any other reason, someone has to enter a password before NT Server will re-establish outbound connections. This

tradeoff could represent a significant management problem in a large distributed network.

When enabling NT security on a network, a userid must be added to every server to which the user needs access. This time-consuming process adds to administrative setup costs and can become another maintenance problem.

An additional chink in NT's security is the exposure that occurs when an unauthorized person boots the NT system from a diskette, because no password, etc. is required. Winn Schwartau, executive director of Inter-Pact Inc., a Seminole, Florida consulting firm and editor of *Security Insider Report,* was quoted in the January/February 1995 issue of *Info Security News* magazine: "NT's boot control is an essential piece of any security system, but the NT floppy drive is a sieve for information. Hackers could have a ball with it." Security is a major corporate concern, and enterprises should be very careful not to be lulled into a false sense of security.

Elsewhere in the same article, Schwartau makes the following observations:

- "I have a real problem when the first great, huge, new, supported and supposedly secure operating system comes out as weak as and transparent as NT is ... my critical recommendation to info security managers is to forget NT..."

- "Microsoft trying to introduce NT under the banner of federal C2 security will give the wrong impression to corporate America. C2, B2, and the rest have nothing to do with real-world security."

- "Anyone who goes out and buys NT with the hope of securing their systems is in for a rude awakening."

A security alert, pointing out flaws discovered during testing of NT security, was issued in early 1995 by the specialist journal *Virus Bulletin*. It said that a simple infection by a master boot virus rendered PCs running NT totally useless, and all data was lost. The problem can occur on dual-boot systems with DOS. A spokesperson from Microsoft said "We are aware of the problem, and the solution is not to run DOS, since the virus infects through DOS, then NT." This is not an acceptable resolution for NT users, who are forced to have DOS dual-boot systems to run existing DOS applications that are not supported by NT.

OS/2 Warp: OS/2 LAN Server focuses on satisfying five basic security requirements (see the article titled "Security in LAN Server 4.0" in Issue 1, 1995 of this magazine):

- Uniquely identify and authenticate users

- Control user access to remote resources

- Control physical access to workstations and local resources

- Protect against data monitoring and modification

- Audit misuse of the network

A single system image maximizes ease of use for users and administrators.

The security integrated into LAN Server 4.0 lays the foundation for planned improvements that will take LAN Server beyond the C2 level of protection. Two major components of LAN Server security strategy are:

- C2 compliance, which requires security to be built into the base operating system. Base security will be built into future versions of OS/2. IBM is currently working on a version of OS/2 Warp that will provide a basis for LAN Server and other OS/2 applications to achieve C2 compliance.

- Integration of Open Software Foundation's Distributed Computing Environment (DCE) security architecture. In keeping with IBM's commitment to the enterprise, investment protection is a major goal. By using LAN Server as a DCE gateway, access to DCE resources and services can be accomplished without requiring any modification to existing LAN Server clients.

OS/2 LAN Server provides boot-level security to prevent any unauthorized boot from accessing the system. The only way to boot from a diskette is with a special diskette that is created at installation time. This unique diskette is then kept in a secure location until needed.

Various third-party security packages provide excellent system security while allowing flexibility to implement the level of security required by each installation.

Application Compatibility

NT: For users concerned with protecting their investment with existing DOS applications, NT cannot run DOS terminate-and-stay-resident (TSR) utilities, support DOS 16-bit device drivers, or support any device driver that writes directly to the hardware, such as a fax card. Because various DOS applications can require unique environments, OS/2 Warp enables the loading of different AUTOEXEC.BAT and CONFIG.SYS files for each session to create the environments required by those DOS applications. Windows NT does not provide this capability.

Windows NT runs most Windows 3.x 16-bit applications and, with the release of version 3.5, now has the option to run the Windows 3.x applications in separate VDMs, as OS/2 Warp does. However, in a Datamation article from May 15, 1994, titled "You mean NT can't Really Run Windows?" and describing the problems of NT's compatibility with Windows 3.x 16-bit applications using emulation software that Microsoft licensed from Insignia Solutions Ltd., senior editor J. William Semich wrote:

"When NT is running on RISC machines using Alpha, MIPS, or SPARC chips, for example, Insignia code emulates both the Intel x86 chip and MS-DOS operating system as well as all of the hardware and drivers that Windows and DOS expect to call upon.

"On Intel-based PCs, there is no need to use Insignia to emulate the x86 chip, of course. But Insignia still provides all of the Windows 3.1 and DOS drivers for the system hardware that make sure the 16-bit DOS and Win applications are isolated from direct contact with NT's protected Hardware Application Layer (HAL) or the hardware itself."

Because NT 3.5 had to improve on the backward compatibility and performance provided by NT 3.1, further development has occurred, but the implementation is still through emulation. This provides less compatibility and slower performance than with OS/2 Warp or OS/2 Warp Connect.

In summary, the incompatibilities with existing applications on NT are due to the lack of support in the following areas:

- No 16-bit DOS or Windows device drivers
- No VxD's
- 286 (standard) mode only, not enhanced mode
- No DOS TSR support
- Limited PCMCIA support

OS/2 Warp: OS/2 Warp's backward compatibility is designed to protect your current investment in DOS and Windows 16-bit applications, while not relying on emulation.

Semich also wrote:

"Although Insignia's products play a crucial role in letting NT run 16-bit Windows 3.1 apps, Microsoft's own developers worked long and hard on the bulk of the 16-bit Windows emulation code. And they've kept on working long and hard of late to increase the speed at which the next version of NT (note: 3.5) can run 16-bit Windows apps – still, however, using Insignia's technologies. Microsoft developed a concept called Win16 on Win32 (WOW) to enable 16-bit Windows apps to run under NT, even emulating a few Windows 3.1 coding errors in the WOW layer so that all of the applications written to those errors would be able to run."

Essential file and printer sharing requirements using TCP/IP are satisfied by OS/2 Warp's TCP/IP, but not by Windows NT's.

The same article that exposes the NT emulation praises the OS/2 implementation, which uses modified Windows 3.1 code. "Incidentally, it's been more than two years since five or six young programmers at IBM's Boca Raton labs figured out a way to run 16-bit Windows 3.x apps on IBM's then-new, 32-bit OS/2 2.x operating system, in native mode. And they pulled it off in less than three months."

TCP/IP Support

Both Warp and Windows NT support a TCP/IP protocol stack, but OS/2 Warp's TCP/IP includes a richer application suite. This richer application suite enables one to use OS/2 Warp's TCP/IP as a complete solution for communications between an OS/2 Warp desktop and a UNIX server (whether that UNIX is IBM's AIX or HP or Sun or other). Essential file and printer sharing require-

ments using TCP/IP are satisfied by OS/2 Warp's TCP/IP, but not by Windows NT's. NT delivers on its communications promise only if talking to Windows NT servers. This is not open computing, but another example of Windows NT proprietary solutions.

For open computing using an Intel desktop, Warp Connect is the more functional solution, as shown by the comparisons in Figure 2, which are based on Windows NT 3.5.

Microsoft's Enterprise Strategy

A recent print advertisement from Microsoft stated that "An enterprise is just a collection of individuals." While this user-centric approach may appeal to the end user, it simply pointed out to corporate management and information system professionals how little Microsoft understands the unique customization, management, security, service, and support requirements of the business environment. The attitude evident in this advertisement reflects their desktop heritage. While Microsoft has its eyes set on the enterprise, it has not demonstrated the robustness, maturity, scalability, or support mentality required to satisfy this environment.

The lack of understanding of enterprise requirements is apparent in the continued absence of any online transaction processing (OLTP) technology in Microsoft's offerings, and in the continued push of MS Mail, which is dated technology that doesn't even support cross-post-office group messaging. Exchange is two years late and still in beta, with many reported problems.

Windows NT's Positioning within Microsoft's Strategy

Microsoft's enterprise strategy is totally Windows NT-centric, and their main interest is in pursuing companies who have committed to an NT-only environment. BackOffice runs only on NT, and Microsoft has declared that they have no intentions of porting the offerings to any

Function	OS/2 Warp Connect	Windows NT 3.5
Redirected printing to remote TCP/IP print queues for DOS, Win16, Win32S, and 32-bit applications	Yes (LPRMON) [1]	No
Print queue redirection for 32-bit applications to remote TCP/IP print queues [2]	Yes (LPRPORTD)	Yes (LPR Monitor)
Accept remote printing from other TCP/IP clients or servers via LPR	Yes (LPD)	Yes (LPDSvc)
Accept remote commands from UNIX via RSH (can be set to accept commands only from root on a UNIX machine)	Yes	No
Accept remote commands from UNIX machine via REXEC	Yes	No
Basic TCP/IP client programs (telnet, ping, RSH, REXEC, character-mode FTP)	Yes	Yes
TCP/IP FTP server (FTPD)	Yes	Yes
TCP/IP telnet server (TELNETD)	Yes	No
TCP/IP apps (TFTP, TFTPD, TALK, TALKD)	Yes	?
NFS client and server	Yes	No
Drag-and-drop NFS integration	Yes [3]	No
Graphical FTP client	Yes	No
Graphical Web browser	Yes	No
UseNet newsgroup reader	Yes	No
Supports phone line (SLIP/PPP) and LAN TCP/IP access at same time	Yes	?
Telnet-3270	Yes	No
Telnet-5250	Yes	No
TCP/IP (WinSock) support for 16-bit Windows applications	Yes	Yes
SNMP support	Yes	Yes
Supports use of UNIX machine as domain name server [4]	Yes	Yes
Dynamic Host Configuration Protocol (DCHP) [5]	No	Yes
Graphical mail	Yes	No
REXX-language sockets API	Yes	No
REXX-language FTP API	Yes	No

[1] LPRMON is an OS/2 Warp TCP/IP utility that redirects all printing to a selected print port from LPT1 to LPT3 (up to LPT9 with a Lexmark AES driver). Any application (DOS, Win16, Win32s, or OS/2) can benefit, since LPRMON's print redirection is transparent to the application. Print jobs redirected by LPRMON can be routed to any TCP/IP "LPD" print server. LPD is a standard part of any UNIX system, and is also included in OS/2 Warp's and Windows NT's TCP/IP.

[2] LPRPORTD is similar to OS/2's LPRMON, except that it exploits the Workplace Shell by defining nine new printer ports that can be used by any OS/2 application for printing. Windows NT's LPR Monitor is similar to LPRPORTD, but NT cannot redirect DOS application printing.

[3] NFS integration is in the OS/2 Warp Connect add-on kit, already available as a kit for TCP/IP 2.0. Microsoft provides no NFS function for NT.

[4] Domain Name Services allows host names and addresses of TCP/IP machines to be stored centrally on a Domain Name Server instead of in a "hosts" file that has to be copied to every client workstation.

[5] DHCP allows TCP/IP addresses to be assigned dynamically from a range of addresses so that administration of TCP/IP addresses can be controlled from a central server. Without this, the client machine has to know its own address (i.e., store it in a file).

Figure 2. Comparison of TCP/IP Applications Included in OS/2 Warp and Windows NT

other platform. Microsoft's proprietary technology, with solutions that run on NT only, is too restrictive for today's heterogeneous enterprise client/server environment.

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Corporate Client/Server Strategy

The fall/winter 1994 issue of *SQ* magazine contained an article by Diane S. Baron about client/server computing. The article listed six key questions that must be considered in determining the right architecture for a client/server implementation:

1. Does the architecture embrace or promote mission-critical values such as security?

2. Is the architecture comprehensive; does it address all of the necessary functions?

3. Does the architecture restrict you to one platform or one vendor's set of platforms?

4. Does the architecture stand the test of time; that is, will it allow expansion by scaling up or down?

5. Does the architecture take into consideration what already exists, and ensure that current investments are preserved?

6. Does the architecture limit your freedom to choose products from different suppliers, restricting your options to pick the best fit for your environment?

Microsoft: When this list is answered from a Microsoft Windows NT/Back-Office perspective, the positive initial answers very quickly become negative ones – "yes" becomes "no."

- The integration of the client/server functions into the server suite with a BackOffice label appears to simplify a very complex area, until users realize that the implementation is restricted to one vendor's platform. BackOffice runs on Windows NT Server *only*. "Realistically, when you are buying the suite with NT, you're

buying into Microsoft. If someone is concerned about portability and flexibility, they shouldn't buy this suite," said Scott Winkler, vice president of operating systems research at Gartner Group, Inc. in the April 1995 *Client/Server Journal* published by *Computerworld.*

- The scalability problems of NT were previously documented.

- Windows NT lacks compatibility with existing DOS TSRs and device drivers.

- Microsoft's proprietary technologies and interfaces limit the options for integrating components from a range of suppliers into an NT-based BackOffice client/server environment. Microsoft's client/server offerings are limited to the following products, which run on Windows NT Server *only*:

  - SNA Server

  - SQL Server

  - Systems Management Server (SMS) - requires SQL Server (on separate hardware system for best performance)

  - Microsoft Mail (to be replaced by Exchange)

  - NT Server

This is the Microsoft universe of client/server offerings, and it severely limits flexibility in customizing an installation. Microsoft must rely on third parties for solutions and support. Who really owns the problems when they occur?

IBM: As businesses continue to evolve from the host-centric glass house to an open, distributed client/server environment, information technology implementers are facing new challenges. The integration of multivendor solutions with a wide range of scalable products enables the customization that the corporation needs, while allowing each user to view the network as if it were a single system. OS/2 Warp Connect is the

universal client that can connect and integrate into every environment, bringing enhanced usability and productivity to each desktop.

IBM's heritage is the corporation, where mission-critical connectivity and applications are the norm, as opposed to Microsoft's standalone desktop heritage. Because IBM understands the specialized requirements of the corporation, a wide range of offerings are available that can be integrated and tailored for unique business environments.

Microsoft promotes BackOffice as an integrated application server offering, when in fact it is more like a bundle of server products. The current beta contains seven CDs with five installation programs. According to the May 15, 1995 issue of *VARBusiness,* BackOffice must also be ordered as five different part numbers. When customers look at the five products separately versus their business requirements, they will find that IBM has stronger offerings in all areas. Additionally, IBM's range of offerings goes far beyond what Microsoft BackOffice provides.

- SNA

  IBM originated SNA and continues to offer comprehensive services for SNA communications to OS/2, AIX, OS/400, and System/390 servers, supporting numerous connection types to IBM and non-IBM systems alike.
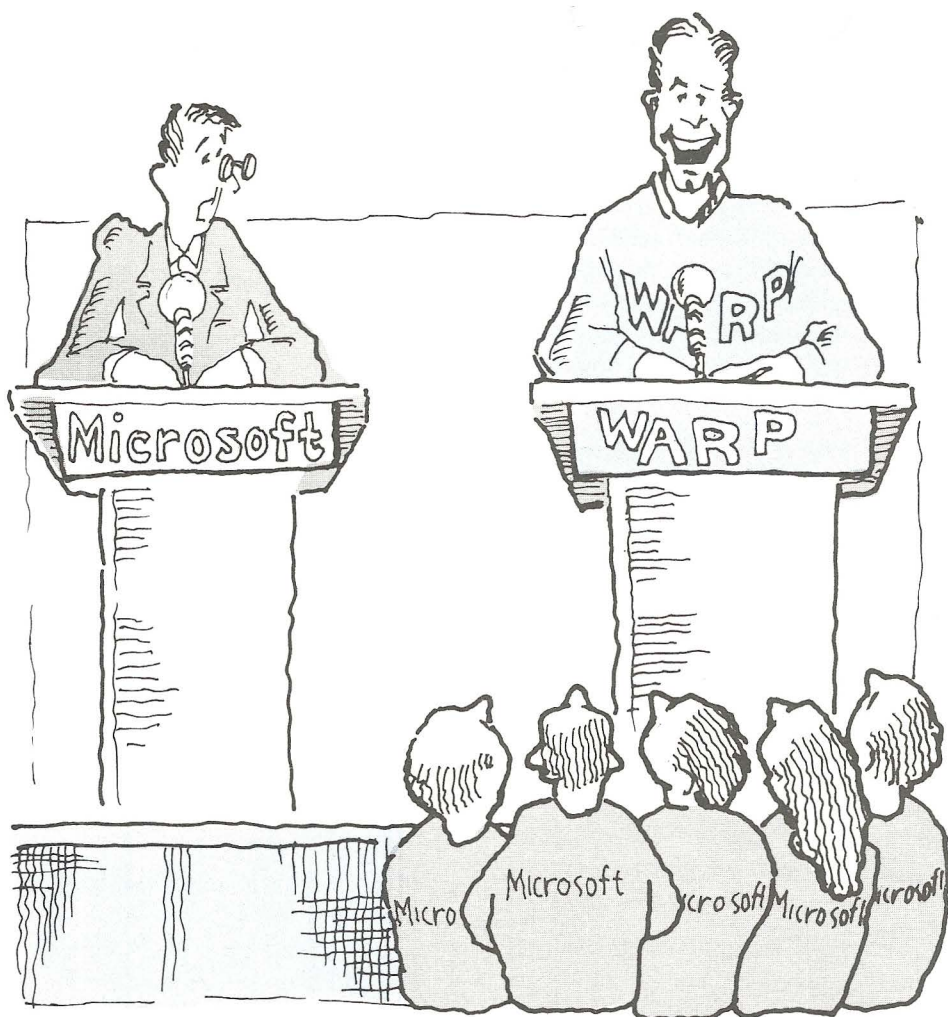
  Microsoft SNA Server = NT only.

- Database

  DB2 provides relational database functions scalable from laptop to SP2 parallel mainframes, across OS/2, AIX, HP-UX, Solaris, VM, MVS, and OS/400 platforms. Connectivity with OS/2, DOS, DOS/Windows, Mac, and AIX clients is supported.

  Microsoft SQL Server = NT only.

- Systems Management

  IBM's SystemView can manage the total, heterogeneous enterprise. IBM

has announced support for SystemView system management across MVS, VSE, VM, OS/400, AIX, OS/2, Sun, HP, DOS, NT, Novell, and Digital. This widest range of clients, across a range of topologies, enables real-world system management, including functions such as remote software installation, performance monitoring, and problem resolution.

SystemView is a platform for creating and executing system management applications. It provides a single, integrated view of the resources on the LAN, from clients, servers, and devices to large systems. SystemView encompasses the following systems management disciplines:

- Performance
- Change
- Configuration
- Problem
- Operations
- Business

Microsoft's Systems Management Server is a first-generation product that provides little to no management beyond Windows desktops, is not DMTF-compliant, and is limited to asset management and software distribution. System Management Server is a Microsoft-only solution that is ineffective in a heterogeneous environment.

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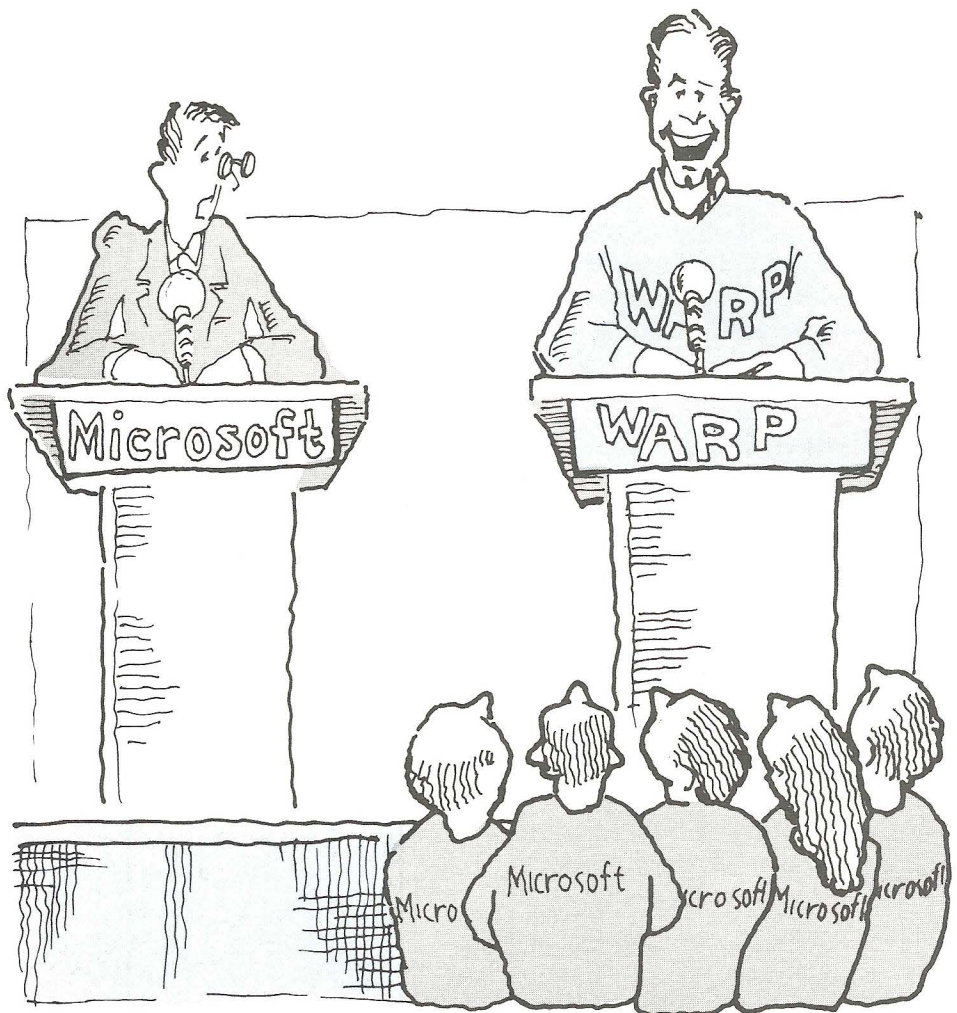
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- Workgroup Applications

  IBM WorkGroup is an integrated group of robust tools specially designed to connect people, resources, and information. Key capabilities focus on workflow, imaging, and document management. Functions include Mail, rules-based agent technology, directory features, scheduling, calendaring, and fax, with a range of products that can be uniquely tailored for each specific enterprise solution. Among the object-oriented products currently available are:

  - Address book synchronization for OS/2 - LAN-based mail systems linked directly to OfficeVision or PROFS for address synchronization.

  - Advanced Server for Workgroups - everything needed for starting a workgroup.

  - BookManager - an integrated solution for creating and reading electronic documents that combine text, graphic, and image files.

  - FlowMark - an object-oriented client/server workflow manager.

  - FormTalk - an E-mail-based forms routing product.

  - Mail LAN Gateway for OS/2 - for dissimilar mail systems to exchange files and mail.

  - Person to Person - IBM's desktop conferencing product.

  - SearchManager - a full-text search and retrieval system.

  - Time and Place - a group calendaring and scheduling product.

  - Translation Manager - an electronic workbench and productivity tool that allows translators to access online dictionaries and text editors from a single interface.

  - Ultimedia Mail - an E-mail system that allows users to author, send, and receive e-mail containing a variety of media types, including sound, motion video, and images.

  - Visual Document Library - a document management and retrieval system.

  - VisualInfo - to convert paper documents into electronic images and manage their storage, retrieval, and routing.

  - Visualizer - IBM's client/server tool set for query, analysis, and presentation of data from IBM and non-IBM relational databases.

- LAN Server Family

  LAN Server is supported on OS/2 OS/400, AIX, VM and MVS platforms. The domain feature connects all of them into a tailored, integrated network with a single system image. The Ultimedia version supports full-motion video and audio, while the Macintosh version enables the integration of Mac users.

  LAN Network Manager is an OS/2-based media management tool that supports multisegment Token Ring LANs, Token Ring hubs, and LAN bridges.

  LAN Distance Family allows users to securely access a LAN from anywhere. A wide range of LAN protocols and LAN-based applications is supported.

- Transaction Processing

  CICS provides for the design, development, and implementation of critical on-line transactions, scalable from the OS/2 single user up through MVS/ESA version 4, which exploits System/390 Parallel Transaction Server. This is a key component in IBM's any-client-to-any-server strategy.

  MQ Series provides high-speed communication between business applications, and allows them to move information into and out of static data servers and application servers. The wide range of supported IBM and non-IBM platforms include: OS/2, AIX, SunOS, HP-UX, SCO UNIX, Digital VMS, UnixWare, OS/400, MVS/ESA, Tandem Guardian, and Stratus VOS.

  Microsoft has no offerings that address the important technologies for client/server solutions addressed by CICS and MQ Series.

- Distributed Computing Environment (DCE)

  Corporations today recognize information as an asset, perhaps one of their most important assets. To optimize the potential value, corporate information must be both accurate and accessible across the breadth of the enterprise. DCE provides the architecture for enterprise information systems.

  DCE enables information technology managers to link different computing resources that were installed at different times, for different uses, across the enterprise. When these resources operate together, the resources can be shared and performance optimized by distributing tasks across multiple platforms. This not only protects current hardware and software investments, but maximizes performance by having information where it is needed, when it is needed.

  The Open Software Foundation (OSF) standard for distributed computing services consists of five components:

  - Remote Procedure Call (RPC)

  - Directory Service

  - Time Service

  - Security Service

  - Threads Service

  IBM has DCE available on all of the major computing platforms, including OS/2, Windows, AIX, OS/400, and MVS/ESA.

  The only piece of the DCE standard supported by Microsoft Windows NT is an emulated, proprietary, incompatible subset of DCE RPC.

IBM Open Industry Standards

IBM is committed to open solutions based on industry standards. Because IBM is a founding and active member of various industry alliances, widely accepted industry standards are integrated into IBM software products, simplifying integration with other suppliers' products. Among IBM alliances are:

- The Open Software Foundation (OSF), which defined the Distributed Computing Environment (DCE) a standard for interoperability. OSF is comprised of IBM, HP, DEC, Siemens-Nixdorf, key UNIX vendors, and over 400 other companies involved in applications, middleware, tools, services, education, and government.

- Common Object Request Broker Architecture (CORBA), on which IBM's System Object Model (SOM) and Distributed SOM (DSOM) are based, in conjunction with AT&T, DEC, Group Bull, HP, Intel, Lotus, Novell, Univel, SunSoft, and Taligent, totalling over 500 industry participants.

- OpenDoc, a cross-platform compound document architecture based on SOM and supported by Adobe, Apple, Novell, Taligent, and WordPerfect.

- Desktop Management Taskforce (DMTF), which has defined the Desktop Management Interface (DMI) for asset management. Among the supporting members are Compaq, HP, Lexmark, AST, Dell, DEC, Novell, and many other hardware system, peripheral, component, and software manufacturers.

- Common Open Software Environment (COSE), which provides a common desktop environment across UNIX environments.

- Taligent, which is an object-oriented operating environment and multiplatform framework alliance among Apple, HP, and IBM.

Service and Support

Microsoft's standalone desktop heritage is apparent in their support paradigm. Traditionally, Windows 3.0 and 3.1 were sold as-is, with technical support consisting of providing how-to's and workarounds, without fix distribution or maintenance releases. Since the range of Windows applications, users, and hardware was so large and varied, it became easy to make scapegoats out of configuration, user, and application problems.

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Supporting back-level releases is a foreign concept to Microsoft. Their common response is "Install the latest release and call back if there is still a problem." This approach is unacceptable and shows lack of sensitivity to the corporate environment, where extensive certification processes make upgrading software a lengthy and expensive proposition, and where large projects roll out over an extended period of time and require the same software on all of the systems.

In the enterprise arena, Microsoft is pursuing three strategies to shore up their support.

First, they are entering into agreements that use other computer companies to provide support. In the March 20, 1995 issue of *The Wall Street Journal,* Microsoft announced an agreement under which VanStar will hire 400 people to set up a nationwide service organization to support NT.

Also, Microsoft currently has 801 authorized technical education centers that train resellers and Solution Providers to sell and support NT as Microsoft Certified Systems Engineers. This is a new and, as yet, untested support structure.

Microsoft Solution Providers are to deliver integration and custom solutions, then provide the support. The knowledge and experience provided by Microsoft Solution Providers will vary considerably. The requirements for becoming a Solution Provider are very simple: Derive 25 percent of the company's revenue from software development, networking, or training and support; have one Microsoft Certified Professional; and pay Microsoft $1,500. An article titled "IT Knocks Microsoft Solution Providers" in the January 23, 1995 issue of *PC Week* stated:

- "At some companies this means one guy took the course and the other 499 didn't."

- "Right now, there is not true accountability. The buck doesn't stop there."

- "Any shop that can pay Microsoft ... can hang out a shingle and call themselves a solution provider."

In this arrangement, Microsoft is responsible for very little of the total solution.

Second, Microsoft offers their own support services. Microsoft is offering three levels of support:

- Information Services (on CompuServe) - For no charge, you can search forums and ask questions related to Microsoft products. The quality and timeliness of the answers is not guaranteed.

- Priority Support - For $7,500 per year or $150 per incident, you can call Microsoft and wait to talk to a specialist.

- Premier Support - For $20,000 per year, Microsoft will support NT Server and BackOffice. This support includes a designated Microsoft repre-

Feature	OS/2 Warp Connect	Windows 95 (estimate)	Windows NT	Windows for Workgroups
User Interface				
Folder Workareas	Yes	Yes	No	No
Integrated object model	Yes	No [1]	No	No
Launch pad / tool bar	Yes	Yes [2]	No	No
Drag-and-drop deletion	Yes	Yes	No	No
Drag-and-drop fax	Yes	No	No	No
Drag-and-drop access paths	Yes	No	No	No
Object-type templates	Yes	Yes	No	No
Parent folder closing	Yes	No	No	No
Application Support				
DOS 16-bit applications: - 286 mode - 386 mode	Yes Yes	Yes Yes	Yes Yes (Intel only)	Yes Yes
DOS 16-bit TSRs	Yes	Yes	No	Yes
DOS 16-bit device drivers	Yes	Yes	No	Yes
Windows 16-bit applications - Standard mode - Enhanced mode	Yes Yes	Yes Yes	Yes No	Yes Yes
Windows 16-bit device drivers	Standard	Standard and VxD	No	Standard and VxD
API support: - Win16 - Win32s - Win32c - Win32 - OS/2 16-bit - OS/2 32-bit - POSIX 1003.1	Yes Yes No No Yes Yes No	Yes Yes Yes No No No No	Yes Yes Subset Yes Yes No Yes	Yes Yes No No No No No
Object-oriented technology: - Inheritance - Encapsulation - Polymorphism - Distributed objects - PC to mainframe - CORBA-compliant programming model	Yes Yes Yes Yes Yes Yes	No [3] Yes No No No No	No [3] Yes No No No No	No [3] Yes No No No No
Document interface	In OpenDoc DKI	OLE	OLE	OLE
Native applications available	2,500	0	1,200	10,000 [4]

[1] Few Shell components are OLE 2.01 objects.

[2] Windows 95 has a taskbar without all of the functions of the toolbar.

[3] Microsoft provides a Windows-based solution, OLE, built on COM. COM is not object-oriented and does not support inheritance.

[4] All Windows 3.x applications.

Figure 3. (1 of 3) Operating System Comparisons

sentative for an account, and faster responsiveness. Microsoft recommends Premier Support for production installations.

Third, another method of support is currently announced for Windows 95, but is expected to be offered across Microsoft's product line. Microsoft will offer a maintenance contract that is more like a subscription service, providing bug fixes, maintenance releases, and upgrades. The $200 to $300 annual subscription cost covering a $100 operating system appears steep, and has elicited some snide comments to that effect in the press. And this annual cost of ownership – $200 to $300 per workstation – becomes very significant to an enterprise that has thousands of licenses.

John McCarthy, an analyst at Forrester, summed it up by stating that Microsoft now wants "... to get incremental revenue from maintenance. More than anything else, it makes their revenue more stable." Microsoft's advantage is for their revenue to be more evenly distributed throughout the year, rather than in spurts on new release cycles.

IBM Service and Support
IBM provides world-class service and support to businesses and enterprises around the world. IBM;'s technical support was recently voted "Best Technical Support of 1994" in *InfoWorld's* annual reader survey. This was an endorsement for IBM's support across the entire spectrum of hardware and software offerings. *IBM technical support is the responsibility of IBM.*

Product Comparisons
Figure 3 compares features and functions of several operating system offerings. The Windows 95 content is based on information printed in available public sources. The OS/2 Warp Connect version referenced in the charts is the Fullpack, which includes IBM's WINOS2 support.

Summary of IBM's Key Competitive Advantages

The key competitive advantages of OS/2 Warp Connect, LAN Server, and IBM scalable servers over Windows NT Workstation, Windows NT Server, and Microsoft BackOffice discussed above are:

- *Value:* OS/2 Warp Connect is a feature-rich operating system that contains connectivity to meet business needs from the smallest home office and the mobile user to the corporation. OS/2 Warp Connect provides a value-packed assortment of network requesters and transports. The BonusPak provides out-of-the box productivity, collaboration, and Internet access, making OS/2 Warp Connect an unprecedented value.

- *Scalability:* OS/2 Warp Connect provides continuity, with one user interface and one consistent API set, from the small laptop to OS/2 LAN Server and SMP systems, with consistent middleware up to the parallel mainframes. OS/2 Warp Connect with LAN Server is the best client/server solution, as well as a component in a scalable family of products designed for customized, open, distributed client/server solutions.

- *Openness:* Support for industry standards, such as X.500, CORBA, Open-Doc, DMTF, and DCE, provides for application enabling, interoperability, and portability.

- *Investment protection:* OS/2 Warp has a seven-year track record of protecting the customer's investment in hardware, software, applications, skills, etc. Upgrading is an expensive, time-consuming operation for a company, and IBM understands that. By maintaining support for 16-bit DOS and Windows applications while providing multitasking and crash protection, OS/2 Warp is still "a better Windows than Windows."

- *Enterprise experience:* When Microsoft advertised that "An enterprise

Feature	OS/2 Warp Connect	Windows 95 (estimate)	Windows NT	Windows for Workgroups
Feature and Function Comparisons				
32-bit window management	Yes	No [5]	Yes	No
32-bit graphic subsystem	Yes	No [6]	Yes	No
32-bit print subsystem	Yes	Yes	Yes	No
32-bit multimedia subsystem	Yes	Yes	Yes	No
32-bit kernel	Yes	Yes	Yes	No
Demand-paged virtual memory	Yes	Yes	Yes	No
Preemptive multitasking: - DOS application - Win16 application - Mixed 16/32-bit applications - Multiple protected Win16 VDMs	 Yes Yes Yes Yes	 Yes No No [7] No [8]	 Yes Yes Yes Yes	 No No No No
Crash protection	Yes	No [9]	Yes	No
Preemptive multithreading	Yes	Yes	Yes	No
Security	Add-on	Add-on	Yes	Add-on
SMP: - architectural limit - practical	 1024-way 4- to 8-way [10]	 None None	 32-way 4-way	 None None
REXX / OOREX	Yes	No	No	No
Plug and play	No	Yes	No	No
PCMCIA	Yes	Yes	Yes [11]	No
Power management	Yes	Yes	Yes	No
Common install	Yes	Yes	Yes	Yes
Install over network	Yes	Partial	Partial	Partial
File support: - FAT - HPFS - 386 HPFS - NTFS	 Yes Yes In LAN Server No	 Yes No No No	 Yes Yes No Yes	 Yes No No No
Bundled Networking Comparisons				
TCP/IP for LAN use	Yes	Yes	Yes	No
NetWare 4.x Directory Services	Yes	No	No	No
APPC communication support	AttackPak	No	No	No
NetWare file and print peer services	Yes	No	No	No

[5] USER is 16-bit non-reentrant code.

[6] Approximately 50 percent of GDI calls are serviced by 16-bit, non-reentrant code.

[7] Win16 MUTEX prohibits access to USER and portions of GDI when a Win16 application is executing.

[8] All 16-bit applications share a single address space.

[9] Key operating system code (USER and GDI) shares the same System VM as 16-bit applications.

[10] In OS/2 for SMP.

[11] PCMCIA card must be inserted before boot and cannot be removed.

Figure 3. (2 of 3) Operating System Comparisons

Feature	OS/2 Warp Connect	Windows 95 (estimate)	Windows NT	Windows for Workgroups
Client/server mail	Yes	No [12]	No 12	No [12]
Port-to-port file sharing	Yes	Yes	Yes	Yes
Remote access	Yes	Yes	Yes	Yes
Internet access	Yes	Plus Pack	No	No
Peer networking	Yes	Yes	Yes	Yes
TCP/IP application support:				
- News reader	Yes	No ?	No	No
- Mail	Yes	No ?	Yes	No
- Gopher	Yes	No ?	No	No
- WWW explorer	Yes	No ?	No	No
- Graphical FTP	Yes	No ?	No	No
- Full telnet (3270, 5250, etc.)	Yes	No	No	No
- Distributed print (LPR/LPD)	Yes	No ?	No	No
- X-Windows	Add-on	No ?	Add-on	No
TCP/IP access:				
- Remote (SLIP/PPP) and LAN	Yes	Yes	Yes	No
- Remote and LAN access at the same time	Yes	No	No	No
Mail (SNMP)	UltiMail	No [12]	No [12]	No [12]
Fax	Yes	Yes	Add-on	Yes
Mobile file sync	Add-on	Yes	No	No
ASCII terminal emulation	Yes	Yes	Yes	Yes
3270 terminal emulation	AttachPak	Add-on	Add-on	Add-on
Performance monitor	AttachPak	Add-on	Yes	Add-on
Multimedia Comparisons				
Image viewer	Yes	Some	No	No
Photo-CD support	Yes	No	No	No
Video Conferencing	Yes	No	No	No
Autodesk animation	Yes	No	No	No
CD autoplay	No	Yes	No	No
3-D graphics	No	No	Yes	No
MPEG support	Yes	No	Yes	No
32-bit audio/video playback	Yes	Yes	Yes	No
Bundled Application Comparisons				
Word Processor	Yes	Yes [13]	No [14]	No
Spreadsheet	Yes	No	No	No
Database	Yes	No	No	No
Personal information manager	Yes	No [15]	No [16]	No
Fax	Yes	Yes	No	Yes
Peer E-mail	Yes	No	Yes	Yes
Discussion databases	Yes	No	No	No

[12] Microsoft Mail is a separately available product.

[13] Windows 95 beta ships with a write applet.

[14] Windows NT ships with a simple text processor.

[15] Windows 95 beta ships with simple applets.

[16] Windows NT ships with a cardfile only.

Figure 3. (3 of 3) Operating System Comparisons

is just a collection of individuals," their lack of understanding of the unique needs of businesses became obvious. On the other hand, IBM's global enterprise experience means that IBM understands real-world problems.

IBM's commitment to the enterprise is evident in its product line, which embodies strategic enterprise solutions that include:

– *Open Blueprint* - a set of services needed to enable applications in an open, distributed, heterogeneous environment.

– *Object-oriented technology*

– *Distributed Computing Environment* - a framework for constructing, connecting, and interoperating heterogeneous computer systems.

– *Systems Management* - through IBM's SystemView, which can manage the total, heterogeneous enterprise. The widest range of clients across a range of topologies allows for real-world system management.

- *World-class sales, service, and support:* IBM technical support was recently voted "Best Technical Support of 1994" in *InfoWorld's* annual reader survey.

- *Advanced technology to provide business solutions:* IBM is the world's leading investor in research and development. In 1994, IBM was awarded 1,298 patents compared to Microsoft's 35, a clear indication of the level of innovation that IBM offers.

OS/2 Warp Connect, PowerPC Edition: Overview

*PSP Marketing Communications
IBM Corporation*

This article gives an overview of the OS/2 Warp Connect software offering for the new PowerPC microprocessor-based personal computers. OS/2 Warp Connect (PowerPC Edition) is currently being beta-tested.

The article describes the advantages of OS/2 Warp Connect, and explains the benefits of OS/2 Warp Connect (PowerPC Edition), the IBM Power Series hardware, and the IBM Microkernel. IBM technologies and strategies for Human-Centered interfaces are also discussed.

OS/2 Warp Connect is the system for business computing. It is a complete connectivity package that can save you time and money in setting up a network. It can improve the productivity of your business as a whole. Combined with IBM LAN Server 4.0, OS/2 Warp Connect provides a reliable, high-performance client/server environment on x86 systems today.

OS/2 Warp Connect comes network-ready, giving desktop and mobile users the ability to connect to colleagues, PC-to-PC and over a network, from anywhere in the world. They save time and money by sharing information, programs, and devices, such as printers and modems. And OS/2 Warp Connect comes complete with Lotus Notes Express, TCP/IP for dial-up and LAN access to the Internet, and access to the most popular online services.

Designed for Interoperability

OS/2 Warp Connect is designed to connect to multivendor network servers using a variety of network protocols. Thus, it can support the way client/server computing is carried out in the typical, heterogeneous business enterprise. With OS/2 Warp Connect, customers are free to choose the best products for their business from different vendors. They can take advantage of new technologies, while continuing to use the software and hardware they already have in place.

Built-in requesters are included for IBM LAN Server and Novell NetWare. OS/2 Warp Connect also can interoperate with IBM LAN Server, Novell NetWare, Microsoft servers, LANtastic from Artisoft, and other servers.

"OS/2 Warp Connect provides a full range of connectivity options for us no matter where we are. That's really important," said Brent Byrd, director of Technology Services for the Lee Apparel Company. Lee finds that OS/2 Warp Connect fits its needs for connectivity like a favorite pair of jeans. Lee chose OS/2 Warp Connect to link its salesmen on the road, its workstations on multivendor hardware platforms around the country, and its employees working from home. According to Byrd, the most beneficial aspect of OS/2 Warp Connect is its ability to connect seamlessly across multiple hardware platforms. He said, "With Lee's 1,000 workstations spread across the United States, OS/2 Warp Connect lets us enjoy complete connectivity from any PC."

OS/2 Warp Connect with LAN Server 4.0 is gaining momentum as a server environment for enterprise users because of its strengths in systems management, heterogeneous systems support, and support for open standards. OS/2 LAN Server 4.0 was named Departmental Network Operating System Product of the Year by the editors of *LAN Magazine* (April 1995).

Access Anywhere in the World

IBM Peer for OS/2 connects directly to PCs running either IBM Peer, Windows for Workgroups, or server software from IBM and other companies. Mobile users anywhere in the world can link either to each other or the office LAN with IBM LAN Distance Remote.

With the remote access feature of OS/2 Warp Connect, Lee's sales staff and technical directors can work from "portable offices" on the road. Executives can access their Executive Information System wherever they are and can obtain up-to-date information about sales, shipments, returns and profits. "Things happen so fast, we need to stay in constant communication," Byrd said. "OS/2 Warp Connect lets our management team and staff be responsive to the news of the moment."

Support for Distributed and Workgroup Products

OS/2 Warp Connect supports key IBM distributed products, such as the DB2 family of relational databases, Communications Manager/2, the CICS family of transaction processing systems, and SystemView Agent for systems management.

IBM WorkGroup provides OS/2 Warp Connect users with integrated communications, work management, and information management functions to help streamline the way teams get work done. Modular and customizable software functions, ranging from robust e-mail and document management to workflow, are included in IBM WorkGroup.

Initially, IBM WorkGroup offers integrated mail, scheduling and calendaring, directory, fax, and agent functions. Other advanced functions that are available in stand-alone products and will also be integrated into IBM WorkGroup include FlowMark for workflow management and Visualizer for data analysis.

For enterprise customers, IBM is delivering advanced networking support in a separate CD package for OS/2 Warp Connect users. This CD will include the capability to do 3270 terminal emulation for up to two sessions using the IEEE 802.2 interface.

Workstation Power Made Affordable on the Desktop

The PowerPC Edition is the OS/2 Warp Connect software offering built on the IBM Microkernel-based architecture for use on PowerPC desktop and laptop computers. It contains the same award-winning user interface and 32-bit, high-performance as OS/2 Warp Connect, along with similar connectivity software and BonusPak programs. OS/2 Warp Connect (PowerPC Edition), combined with PowerPC systems, provides outstanding performance to the desktop and mobile user, while protecting prior investments in software and skills.

OS/2 Warp Connect (PowerPC Edition), combined with PowerPC systems, provides outstanding performance to the desktop and mobile user, while protecting prior investments in software and skills. Those who can benefit from this one-two hardware and software punch include:

- Users who want to:
  - Obtain a boost in processing power for OS/2 Warp applications while still being able to run their current DOS and DOS/Windows applications. Existing DOS and Windows applications run as-is on OS/2 Warp Connect (PowerPC Edition) through high-performance translation technology. At the same time, 32-bit OS/2 applications need only be recompiled to take advantage of PowerPC hardware.
  - Make use of new applications being written for the OS/2 Warp family of products – programs that require increased computing power. New applications are being developed that deliver:

Human-Centered interfaces. An example is speech recognition, which enables you to give commands to your computer by voice, and to request intelligent programs to perform tasks for you.

Object-oriented technology, which simplifies tasks for users of the OS/2 Warp Workplace Shell interface. It also makes programming more productive and intuitive because of the modular, task-centered approach and the reuse of existing software in new programs.

Collaborative computing, which enables you to work efficiently with remote team members or customers. For example, your team can view and mark up documents simultaneously with pen and audio comments, and can even conduct video conferences.

  - Obtain high performance and energy efficiency on portable systems.
  - Run high-end workstation applications on standard desktop personal computers. Examples are engineering and scientific, modeling and simulation, imaging, and Computer-Aided Design / Computer-Aided Manufacturing (CAD / CAM) software.

- Programmers who want to:
  - Use a powerful platform that can handle the complex algorithms required for developing new human-centered, object-oriented, and multimedia programs.
  - Take advantage of the efficiency and flexibility of the IBM Microkernel-based architecture. With the IBM Microkernel, programmers can insert various new operating system services without dealing with or disrupting the rest of the system.

- Specific industries, such as health care, that value both the low power consumption of the PowerPC for

mobile systems and the ability to talk to the computer, leaving the hands free for patient care.

Benefits of the IBM Power Series Hardware

The IBM Power Series is a family of hardware products based on the PowerPC microprocessor. It is designed to provide increased performance, lighter designs, richer graphics, and enhanced ease of use to meet users' requirements for expanded integration of PCs with telephony, fax, communications, and video.

PowerPC-based systems are the first marriage between the RISC and PC worlds. Until now, RISC computing has represented powerful performance and industrial-strength applications typically associated with workstations. RISC, which stands for reduced instruction-set computer, is a technology invented by IBM, as was the POWER Architecture. Together with Motorola and Apple, IBM developed the PowerPC chip to combine these forces to deliver a family of systems that bridges the gap between workstation power and desktop affordability.

The Power Series systems take full advantage of OS/2 Warp's 32-bit multi-tasking and multithreading capabilities, and deliver an open architecture and cross-platform compatibility, providing a robust hardware and software package for demanding client/server environments.

The Power Series also comes loaded with ready-to-use features, such as speakers, microphones, and CD-ROMs, which will support applications with richer capabilities. For the first time, with the PowerPC, there is an inexpensive microprocessor available with the processing power to deliver speech recognition, multimedia, and so on, without sacrificing performance in other areas and without requiring an extra investment in hardware.

IBM Power Series System	PowerPC Microprocessor	Advantages
IBM ThinkPad Power Series 820 and 850	PowerPC 603e (100 MHz)	The low-power design and the power management feature provide the competitive advantage in content-rich portable applications.
IBM Personal Computer Power Series 830 and 850	PowerPC 604 (100, 120, and 133 MHz)	The three-stage, double precision floating-point unit lets you take advantage of increasingly graphics-oriented software packages as well as multimedia applications, providing performance capabilities previously available only through expensive add-on hardware.

Figure 1. IBM Power Series Products

Figure 1 summarizes IBM's Power Series products.

Designed for the Future: IBM Microkernel-Based Architecture

Modular Building Blocks: The IBM Microkernel was designed to fill customer requirements for portability and scalability. The types of processors being developed for personal computer systems are becoming increasingly diverse. Traditional monolithic operating systems built to a particular processor architecture cannot be easily and quickly moved to new families of processors. However, the IBM Microkernel enables the operating system to be largely independent of the hardware processor.

This architecture changes today's traditional operating system into simplified, modular building blocks. The most essential functions of an operating system are contained in the microkernel module, and only a part of that module is hardware-dependent. Other operating system services are contained in separate modules that are not hardware-dependent.

The user interfaces and application program interface set for operating systems are contained in separate modules called operating system services. The PowerPC Edition has modules for OS/2 Warp and DOS/Windows.

There are modules for shared services, such as database engines, file systems, and communication software. Innovative shared services for specialized applica-

tions can be developed by different vendors so that, for example, users can plug in whatever database engine they prefer. And, other improvements can be incorporated without compromising the reliability or performance of the remainder of the system.

Advantages of the Modular Architecture: Through this new architecture, OS/2 Warp is becoming portable across hardware platforms. This operating system portability enables you to run your current x86-based DOS and DOS/Windows applications as-is on the powerful RISC-based systems. And you can run current 32-bit OS/2 Warp applications after they have been recompiled. Additional training is not needed when you can use applications you are already familiar with. This modular structure also can make new technology available more rapidly than in the past.

For developers, a single set of source code that supports multiple platforms makes it possible to sell more applications on different types of hardware – without the cost of developing and maintaining different code for each platform.

The Microkernel-based architecture can give developers access to new technologies more quickly, so they can create new software functions or make use of new hardware functions. Programmers can use their existing skills because they just continue to use the OS/2 32-bit API set for x86-based PCs, but now their programs will also run on PowerPC-based systems. The PowerPC Edition is designed to run on all computers complying with the PowerPC Reference

Platform standard, both IBM and non-IBM PowerPC systems.

With modular construction, only the pieces of the operating system required for a specific implementation are deployed. This makes the IBM Microkernel ideal for all types of devices from engine management systems in automobiles to personal digital assistants (PDAs) to desktop computers and multiprocessing superservers. Components written to the IBM Microkernel interface can be reused by other implementations that use the microkernel.

Trevor Hill, system development manager for (U.K.) Esso Petroleum's distribution department, sees value in being able to add PDAs, using compatible software, for Esso truck drivers, who have on-board trip computers. Esso Petroleum, England, uses OS/2 Warp products to safely and reliably control and monitor, from a central control room, the distribution of their gasoline, diesel, and aviation fuel through the U.K. According to Hill, "...the people who deliver the products will be able to talk right into the PDA and capture that, so I think that it's not just in the control room, it's moving across the whole spectrum of the operation."

Human-Centered Interfaces

Evolving to More Natural User Interfaces: IBM is developing Human-Centered technologies to provide more natural user interfaces to the computer, so that you could, for example, dictate a letter and use a pen or voice command to send the letter to a colleague. To en-

able you to more fully use your human abilities, the Workplace Shell is being extended over time with multimedia, speech recognition, and pen and touch technologies. Human-Centered technologies will enable developers to set new standards for user interfaces.

Today, with OS/2 Warp and one of the BonusPak products, IBM Person to Person, you can view a document with several colleagues in separate locations, and annotate your comments with a pen while your remote co-workers view your markup. You can also use the pen to execute commands by touching it to areas of the screen. You can even conduct video conferences by adding video cameras and video capture adapter cards to PCs. The IBM ThinkPad Power Series 850 notebook comes standard with a motion video adapter card (for both video in and out) and an optional snap-in video camera.

"With Person to Person built into it, OS/2 will let us extend our long-distance learning capabilities," said Jeremy Meharg, department head of Educational Technologies at Burnaby South Secondary School in British Columbia, Canada. "The chalkboard feature will let teachers not only peek on students' workstations, but it will permit students to work with other students in a collaborative environment."

Today you can even talk to your computer using IBM VoiceType Dictation. This product has a vocabulary of 30,000 words and recognizes words as fast as a good typist can type. Use it also to command and control your desktop with your voice. For example, you can select icons, open folders, and move windows. The capabilities of the award-winning VoiceType product will be available in the future for the PowerPC Edition as part of the Human Center, which is described below.

"I'm very excited in improving the desktop systems for our operators," said

Trevor Hill of Esso. "They took very readily to the change in technology which they have now ... essentially a mouse and a keyboard. If we can provide them with even more intuitive interfaces, where they can talk to the computer and it can respond back in a natural fashion, I believe they will find the job even more rewarding and less boring."

Hill also said, "The ability of voice technology and the ability to interact – say, 'turn a valve off' – as you would with a human being, gives us a lot of capability which we think will provide us with more benefits than we ever thought possible."

The Human Center Conversational Interface

Talking, Not Typing: Besides giving a power boost to existing products, the PowerPC Edition will enable you to access the Human Center, which is a conversational interface. The Human Center extends the Workplace Shell interface by adding the ability, through IBM's award-winning speech products, to use the voice to command and control the computer or give dictation. The Human Center will be included with the purchase of an IBM Power Series computer.

The command mode is a user-independent, untrained recognition facility used to control actions on the computer by spoken input. Predetermined phrases are provided that the system will recognize and execute. Dictation involves training the system to recognize your specific speech patterns for a large vocabulary.

Technologies for both speech recognition and conversational language interpretation are used to recognize speech and make sense of what you are trying to say. The interpretation engine converts words into phrases that the computer can act upon. This takes the

burden of the exchange off you and puts it on the system, enabling you to concentrate on the tasks to be accomplished rather than the words needed to get things started.

These technologies will appeal to users unable to use or uncomfortable with current computing solutions. Anyone with a hands-on type of job, from a surgeon to a car mechanic, could benefit from hands-free computing. This means an expanding market for developers. And, whereas in the past speech recognition required additional hardware (for example, a speech adapter card was needed to use IBM VoiceType Dictation), the PowerPC processor now has the power to provide these capabilities.

"I think OS/2 is one of the most important platforms for human-centric applications. They do multimedia, and look at what they are doing right now with voice technology – voice command control and voice dictation," said Marco Boerries, president of Star Division. "You can buy that off the shelf right now. I really think they have a head start as far as the competition goes. And, I'm expecting them to do much more in the future."

For the future, IBM plans to increase the vocabularies and lessen the training requirements for dictation. The long-term goal is to provide speaker-independent dictation capability.

Having an Agent to Assist You: A major feature of the Human Center is the introduction of conversational agents, or programs that perform some useful function on your behalf, saving you time and effort. Some types of activities that could be performed by agents are file or database management, remote information retrieval over a network, and repetitive keystroke input.

An agent can be given an graphical face on the screen and a voice (called an *actor),* or it can be transparent to the user. Different styles of actor are select-

able, from cartoon-like, line-drawn figures to serious and attentive assistants derived from bitmaps. Actors' voices are provided by text-to-speech technology, and will include male and female voices. Voice output can be engaged without having an actor's face on-screen.

Initially, IBM's Human Center will provide a Human Center Agent to manage the interface; a Phone Agent to dial and receive or send voice mail, messages, and faxes; and a Mail Agent to handle electronic-mail messages. These can be immediately useful to users, and can also demonstrate how conversational agents can be constructed. Developers can write their own agents as front-ends to their applications when the developer's toolkit becomes available.

Expressing Your Thoughts More Naturally: A document annotation program, called IBM HC Markup, is included with the Human Center. With HC Markup, you can bring in documents created by other word-processing applications, such as Lotus Notes or WordPerfect; annotate them with audio, video, highlighting, or other text markings; and then send them to a co-worker. HC Markup can be employed to create documents using Human-Centered technologies, or just to annotate those created under other applications. People receiving these updated documents may view or annotate them using HC Markup in the Human-Centered application set under Windows NT (Power Series Edition) or HC Markup for Windows 3.1.

Building Now for the Future
In choosing software, one looks for products that are compatible with one's existing hardware and software, and that also provide the benefits of new technologies to help improve overall productivity.

IBM meets these software needs by providing compatible products like the award-winning OS/2 Warp, which runs most applications in the marketplace.

OS/2 Warp products also scale a broad range of hardware, from portable systems to multiprocessing servers, and run across IBM-compatible x86 computers from multiple vendors.

The PowerPC Edition makes OS/2 Warp and your applications portable to new technologies like the PowerPC hardware systems. At the same time, OS/2 Warp continues to be the most popular 32-bit system on x86 PCs. This gives users more choices in hardware platforms without requiring them to acquire and learn new applications. It provides programmers with an easy way to reach new markets for their software products.

"The future OS/2 promised in the past is happening now ... in OS/2 Warp," said Jeremy Meharg of Burnaby school. "I really feel good about the decision we made to invest in OS/2 a couple of years ago because it is starting to show off some of the things we only dreamt about back then."

The PowerPC Edition provides these additional benefits:

- The advantages of OS/2 Warp Connect – the proven OS/2 Warp 32-bit multitasking operating system with the Workplace Shell user interface, plus similar connectivity software, productivity programs, and Internet access

- Greater processing power for OS/2 Warp applications and the ability to run your current DOS and DOS/Windows applications

- High performance and energy efficiency on portable systems

- The ability to run high-end workstation programs on your desktop

- Access to developing technologies, such as Human-Centered and collaborative computing

- A powerful platform that is ideal for developing 32-bit software, especially multimedia, collaborative computing,

mission-critical business, and Human-Centered applications

- A modular architecture that can simplify programming new system service modules, and open up new markets to software vendors

- The freedom to add new technology at your own pace without having to replace existing hardware and software

A Quick Look at OS/2 Warp Connect (PowerPC Edition)
The following features are planned for OS/2 Warp Connect (PowerPC Edition). Based on the results from testing, the PowerPC Edition is planned to be generally available in the fourth quarter of this year.

Basic features:

- Runs 32-bit OS/2 applications after they have been recompiled to take full advantage of native PowerPC potential.

- Runs your DOS and DOS/Windows programs. PowerPC Edition accomplishes this using high-performance instruction set translation technology.

- Multitasking enables multiple programs to run on the desktop at the same time so you can do many tasks at once.

- Provides ease of use through the award-winning Workplace Shell:

  – Quick installation

  – Customizable desktop

  – Toolbar gives you quick access to functions you use the most

  – Excellent visual cues, such as 3-D icons

  – Tutorial lets you practice tasks on the actual desktop

  – You can set up multiple desktops for co-workers or family

- The PowerPC Edition enables you to take advantage of the new Human Center conversational interface.

Developer Assistance

IBM provides assistance to software vendors who are developing programs for OS/2 Warp products on x86 and PowerPC hardware. This assistance covers a variety of support services, including technical support, hardware and software discounts, and a set of marketing support programs.

For developers wanting to convert their Windows applications to OS/2 Warp, IBM makes available the SMART set of tools, which migrates most of a 16- or 32-bit Windows application to OS/2 Warp automatically.

IBM has new Developer API Extensions that enhance the portability of 32-bit Windows applications to the proven OS/2 Warp products. These extensions help software developers deliver their applications across PC operating systems including OS/2 Warp, Windows 3.1, Windows NT and the forthcoming Windows 95.

The Developer API Extensions are comprised of a subset of more than 700 APIs and 300 messages that are consistent with Win32 APIs and messages. This subset includes the most frequently used Win32 APIs in popular Windows applications.

Windows applications that use these APIs can be recompiled to produce functionally equivalent OS/2 Warp applications.

The Developer API Extensions for OS/2 Warp on x86 systems are being made available for beta testing this summer, and IBM plans to make them generally available by the end of the year. In the future, they will be shipped with OS/2 Warp products, and will also be made available for the PowerPC Edition.

The IBM Developer Connection

The IBM Developer Connection for OS/2 provides the latest x86 application development tools, pre-release software, product demos, and information. If you want to recompile an OS/2 32-bit application to run on the PowerPC Edition, the Developer Connection provides the application development tools you need to get started.

Contact the IBM Developer Connection for OS/2 at 1-800-6DEVCON (U.S.) or 1-800-561-5293 (Canada). Other countries are listed at the end of this section.

To participate in the beta-test program for the PowerPC Edition, you should have an existing OS/2 Warp 32-bit application that you have recompiled. Otherwise, you should plan to develop an OS/2 Warp 32-bit application, or port an existing DOS or DOS/Windows application to OS/2 Warp (32-bit). The OS/2 Warp tools to support this effort are available from the Developer Connection. Following this procedure enables you to increase productivity and take advantage of the growing marketplace for OS/2 Warp products.

For information about participating in the beta-test program for OS/2 Warp Connect (PowerPC Edition):

Members of the IBM Developer Assistance Program should contact their Solution Developer Operations relationship manager.

Corporate developers should contact their IBM OS/2 marketing specialist.

To contact The IBM Developer Connection for OS/2 in countries other than the U.S. and Canada:

Please dial the international access code applicable to your country before the listed phone number. Note that 61 is the country code for Australia, and 45 is the code for Denmark.

In Asia/Pacific countries: 61-2-354-7684
In Brazil: 0800-111205
In Mexico: 91-800-00316
In Germany: 0130-812177
In Europe:
- Danish: 45-4-810-1300
- Dutch: 45-4-810-1400
- English: 45-4-810-1500
- Finnish: 45-4-810-1650
- French: 45-4-810-1200
- German: 45-4-810-1000
- Italian: 45-4-810-1600
- Norwegian: 45-4-810-1250
- Spanish: 45-4-810-1100
- Swedish: 45-4-810-1150

- The initial PowerPC Edition to be released will include IBM WIN-OS2, which provides Windows application support.
- Kodak Photo CD support (read-only) built in.
- OpenGL for OS/2 provides the industry standard 3-D support and API set, which gives developers and users access to graphics capabilities previously available only on high-end workstations.

Connectivity features:

- A complete network client for the LAN Server family, TCP/IP, and Microsoft servers
- Support for these networking protocols: NetBIOS, IEEE 802.2, TCP/IP, and SNA APPC and APPN
- Streamlined installation for connectivity software
- TCP/IP for OS/2 lets you cruise the Internet using a LAN connection.
- TCP/IP protocols also let you send and receive e-mail, transfer files, do remote printing, and more.

BonusPak features:

The BonusPak for the PowerPC Edition contains software that is similar in function to the productivity and online connection software contained in the OS/2 Warp, Version 3 BonusPak.

Related information

For a complete list of the applications being developed to date for the PowerPC Edition, see the *IBM Power Series Solutions Directory* (G326-0567). You can obtain the Directory through the IBM Fax Service by calling 1-800-IBM-4FAX and requesting document number 3642.

For more information about IBM products and services, see the IBM Internet World-Wide Web Home Page, `http://www.ibm.com`.

15 Questions About Windows 95

(This is a position paper produced by IBM Personal Software Products Marketing Strategies.)

Can Windows 95 live up to the hype that Microsoft has generated for it? These questions, which are based on published information about the final beta product in the Windows 95 Resource Kit and *Windows 95 Reviewer's Guide,* can help you decide.

Reliability

Q: What happens to 32-bit applications when a Win16 application crashes under Windows 95?

A: The 32-bit applications can stop executing. Because Microsoft built Windows 95 using the same System Virtual Machine (VM) model found in Windows 3.1, the operating system is at the mercy of legacy 16-bit applications. If a Win16 program hangs, it can tie up critical 16-bit code modules located in the System VM. All other processing is halted.

Bottom line: Windows 95 is not a reliable platform for mission-critical, line-of-business applications.

Q: Does Windows 95 protect the contents of its system cache against intrusion by Win32 programs?

A: No. As with the aforementioned system structures, Windows 95 also fails to protect the contents of its system cache – disk cache, network cache, and CD-ROM cache. As a result, an errant
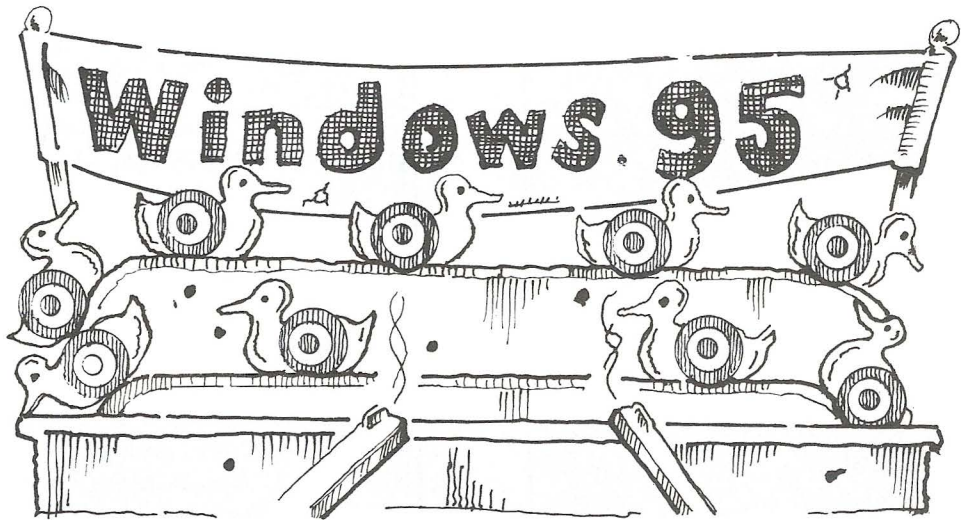
Win32 application can write to memory being used by the cache. The potential results: inaccurate data, corrupted file system entries, and so on.

Bottom line: Data integrity is a question mark with Windows 95.

Q: How is Microsoft dealing with the issue of Virtual Device Driver (VxD) instability?

A: They aren't. In fact, Windows 95 itself makes heavy use of VxDs to supplement and, in many cases, to replace DOS functionality. VxDs are extremely powerful programs that can literally go anywhere and do anything in the operating system. They have free reign to address system memory directly, manipulate hardware, and even replace portions of Windows 95 itself at run-time. This gives the creative VxD programmer unlimited flexibility when designing applications that need to modify Windows 95's operation. Microsoft has itself often promoted the VxD interface as a mechanism for gaining good performance with time-critical Windows applications. Unfortunately, the power of the VxD can also be a curse. As more

developers begin to exploit this interface – an interface that has only limited controls and almost zero interprocess isolation – a programming free-for-all may result, where multiple third-party VxDs modify the system in similar ways, with unpredictable results. The failure of a single VxD can undermine the stability of the entire Windows 95 environment.

Bottom line: VxDs in Windows 95 are potential disasters waiting to happen in corporations worldwide.

Q: Is it true that Windows 95 doesn't fully protect its own operating system code against Win32 application failures?

A: Yes. Win32 applications can write to regions of the extreme lower and upper address spaces in the System VM that are critical to the environment's operation. As a result, an errant memory operation can undermine system stability and potentially crash the entire operating system.

Bottom line: Windows 95 may be one errant memory operation away from total failure.

Q: When running DOS applications, does Windows 95 fully virtualize the PC's hardware to protect against buggy applications?

A: No. Windows 95 fails to virtualize critical hardware components like the interrupt flag. This, in turn, can lead to a system crash if an errant DOS program becomes unresponsive while interrupts are disabled.

Bottom line: Legacy apps are the Achilles' heel of Windows 95 memory management.

Usability

Q: Does Windows 95 track objects dynamically?

A: No. Windows 95 uses a series of static DOS pathnames and .INI files to track the relationship between icons on the desktop and files on disk. For example, the shortcut mechanism of the Windows 95 interface relies on a stored copy of the original's path information when locating and invoking it. If the file is moved within the directory structure, Windows 95 must search the hard disk for it, based on file size and date stamp. Although this technique works most of the time, it is limited to searching a single volume – if you move the file to another disk volume, the link is broken completely. And, because Windows 95 will search your entire network if attached, it may take forever if it is connected to, say, five gigabytes of storage.

Bottom line: Help-desk calls will be on the rise as Windows 95 users experiment with shortcuts and long filenames.

Q: Does Windows 95 make consistent use of drag-and-drop?

A: No. Windows 95's drag-and-drop features are applicable to some objects, like files and folders, but not to others. You cannot, for example, drag a dial-up networking connection to the Windows

95 Recycler, nor can you drag objects to the My Computer folder – both are "special" objects in the Windows 95 interface and aren't subject to the normal Windows 95 drag-and-drop rules. This introduces a level of inconsistency to the interface, and a possible stumbling block for new users trying to take advantage of drag-and-drop.

Bottom line: The Windows 95 interface is inconsistent from function to function.

Q: Is the Windows 95 interface consistently object-oriented?

A: No. For example, while you can invoke the right mouse button pop-up menu on most objects, entries in the Start menu and its submenus are not included. This makes manipulating Start menu entries an awkward process involving the Taskbar properties' dialog box and several layers of menus and windows. Since the right mouse button works in most other areas of the interface, the Start button's deviation from this norm exposes Windows 95's object-oriented support as incomplete.

Bottom line: Windows 95 does not fully exploit OO technology.

Multitasking

Q: Can Windows 95 preemptively multitask Win16 applications?

A: No. Because Win16 applications were written for a cooperative multitasking environment, they cannot handle the stress of being "preempted" during execution. Therefore, Windows 95 must handle these applications in the same way that Windows 3.1 does: by giving them exclusive control of the CPU for as long as they are executing. When, and only when, the application makes a specific API call – one of the few such calls that constitute safe points at which Windows can wrest control away from the program – are other programs allowed to execute. This is *cooperative*

multitasking, and has proven to be ineffectual when running more than a handful of programs simultaneously, or when running CPU-intensive programs such as communications, print, and/or fax programs.

Bottom line: Windows 95 adds little value to the large base of legacy Win16 applications.

Q: Are there any caveats to multitasking Win32 applications under Windows 95?

A: Yes. In its effort to maintain a high degree of backward compatibility while simultaneously minimizing the RAM requirements of the operating system, Microsoft has chosen to rely on its existing, Windows 3.1-era USER (window management) and Graphics Device Interface (GDI) modules, rather than create new, 32-bit versions. In order to utilize this older, 16-bit code in the potentially preemptive (with regard to Win32 applications) 32-bit multitasking environment of Windows 95, Microsoft was forced to serialize access to USER and GDI. As a result, only a single Win32 or Win16 program can access these critical modules at any given time. This hurts application performance on heavily loaded systems, because programs are forced to line up and wait for a chance to execute a USER or GDI routine. All USER calls (for both 16- and 32-bit applications) are serialized and handled by the 16-bit code, while the majority of GDI calls are similarly handled (the other 50 percent are handled by newer 32-bit routines).

Bottom line: Windows 95's multitasking is best described as preemptively challenged.

Q: What happens to Windows 95's multitasking when you run a mixture of application types?

A: It reverts to a cooperative multitasking model. Windows 95's continued reliance on the single System VM model of

Windows 3.1 places the operating system's multitasking capabilities at the mercy of the lowest common denominator: the 16-bit Windows application. Whenever a Win16 application is running, the operating system's multitasking capabilities are compromised by the need to allow such programs to execute undisturbed for as long as they require. As a result, when multitasking a mixture of applications – Win16 and Win32 – true preemptive operation is impossible since, at any given time, a 16-bit application may require exclusive control of the CPU. Worse still, since the Win16 application is typically executing a portion of the 16-bit USER or GDI code – access to which must be serialized among processes – all other processes, including Win32 applications, are blocked from executing. The result is what would be best described as "semi-preemptive" multitasking.

Bottom line: When Win16 applications enter the mix, Windows 95 takes on an alternate personality – Windows 3.1.

Q: Does Windows 95's multitasking resolve any of Windows 3.1's multimedia-related deficiencies?

A: Not really. Windows 95's inconsistent multitasking performance – a byproduct of the single System VM model – compromises its performance as a serious multimedia production platform. Complex .AVI clips break up noticeably when a significant I/O strain is placed on a Windows 95 system. Even simple operations, like opening an application program, can have a negative impact on multimedia playback.

Bottom line: In Windows 95, you still can't play multimedia and do heavy I/O simultaneously.

Relationship to DOS

Q: Does Windows 95 really do away with DOS?

A: No. Windows 95, though touted as a completely new, 32-bit operating system, is in fact still based on DOS technology that dates back to the early 1980s. Under Windows 95, even Win32 applications rely on at least a few data structures within the real-mode DOS environment (most notably, they all maintain real-mode PSPs). Despite Microsoft's claims to the contrary, Windows 95 is highly sensitive to the configuration of a PC's real-mode DOS environment. For example, if the available conventional memory in the System VM – the DOS virtual machine where all 16-bit Windows applications and some Windows 95 code execute – dips below a certain level, Windows 95 will report "out of memory" messages when you try to open additional Win16 or Win32 programs. This is unrelated to the well-known System Resources phenomenon, and the only practical solutions are either to replace as many real-mode device drivers as possible with VxDs or to invest in a third-party memory manager to optimize the pre-Windows 95 DOS environment.

Bottom line: Windows 95 can be viewed as DOS/Windows, with a new interface and some new VxDs.

Q: What is Single MS-DOS Application mode, and how does it affect other running applications?

A: Microsoft touts Single MS-DOS Application (SMA) mode as its ultimate solution to any and all DOS compatibility complaints. SMA is essentially real-mode DOS, except that instead of booting DOS and then loading Windows, the order has been reversed: You first boot Windows 95, then "unload" it as the machine is reset into the real mode of SMA. This indeed eliminates virtually all remaining DOS application incompatibilities, since the PC is no longer running in V86 protected mode – it has been reset to real mode, loaded with a copy of DOS, and left at a command prompt. What Microsoft doesn't like to admit, however, is that to invoke an SMA-dependent application is to essentially shut down Windows 95 – all running applications are closed, network connections are severed, and VxD support for peripherals like CD-ROM drives disappears. To maintain these functions, you need to add real-mode DOS device drivers to your system and then configure them via the SMA dialog box. And since Windows 95 is no longer running, any users who are connected to shared resources on the system are disconnected when it enters into SMA mode.

Bottom line: Windows 95's SMA is really only a viable solution for home users and other non-networked environments.

Q: How does Windows 95 handle real-mode DOS device drivers?

A: Windows 95's dependency on the real-mode DOS environment undermines its ability to support DOS applications. Because Windows 95 relies on an "image" of the pre-Windows 95 boot-up environment when creating the System VM, and because subsequent DOS virtual machines are similarly based on this boot-up image, Windows 95 users are forced to load any required real-mode device drivers as part of the original boot-up CONFIG.SYS file. The ramifications of this limitation are significant: Each and every DOS session under Windows 95 contains a running copy of, and surrenders valuable conventional or upper memory to, real-mode device drivers. This is true even if the drivers are not required or desired in a particular DOS session.

Bottom line: In Windows 95, there is no way to load a real-mode driver into a specific DOS session – it's an all-or-nothing proposition.

"It Must Be OS/2"

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There's something new going on.

A year ago, when you mentioned OS/2, you'd get a dumb look in response. Most people, even technical people, didn't know what it was.

You see fewer dumb looks nowadays. OS/2 has become a common term, but one that some technicians use unkindly.

One of our several computers always has been troublesome. I kept blaming the video card, since strange things happened when I tried to use a resolution higher than 640 x 480. But I knew something was seriously awry when I tried to boot the system and got a series of beeps. I looked up the beeps in the manual and discerned that the problem was the motherboard.

I called the company's tech support department and started to explain my problem. "I've been running Warp on this system, and I thought my problems were with the video..." I began. The tech support guy cut in immediately. "Oh, it's probably Warp's fault," he said. "We have lots of problems with Warp."

His attitude irked me – so I let loose a tirade of technical jargon that would make my mother blush (if she understood half of it). I made it clear that not only did I recognize a motherboard problem, but I knew that Warp had no part of it.

It didn't take long for the technician to call the on-site repair folks, but that's not the point. What if I had been a less knowledgeable user? I might have believed this guy.

I'm not alone. The next day, I got a message on the File Freeway BBS from an OS/2 user group member. He, too, had a problem with a computer system. When he tried to get the problem resolved, the dealer's technician blamed OS/2. The user group member said "The tech's attitude was that it must be OS/2. When I told him I had it running without any problems on my own machine, he had nothing further to say."

What Can We Do?

Over time, Warp's increased popularity will help to resolve the problem. But what can you do right now? Here are some ideas.

First, find out how much personal OS/2 Warp experience the technician has. On how many systems has he installed it? How much of his time is spent using Warp? How much training has he received on the subject? If the technican is local, this is a good time to invite him to a user group meeting. Be friendly about it, and stress how much everyone learns, rather than implying that he needs to show up because he's an idiot.

Second, ask questions to find out more about his company's experience with Warp. Do they perform full quality assurance testing using Warp? If they don't, then the technician is not in a position to judge whether OS/2 is at fault; he doesn't have enough data to know. Point out, politely, that if their hardware or software really does have a problem with Warp, that (considering Warp's overpowering success) it behooves his company to address any incompatibilities. Ask him to explain how his company is addressing the issues.

The technician may be trying to pass the responsibility for non-working equipment to someone else (IBM, in this case) to cover up his own ignorance. By calmly asking how he and his company are addressing the matter, you pass the responsibility right back to him. If he says "It's an IBM problem, they have to solve it," remind him of his competitor's products that work trouble-free; it is to his company's benefit, and its bottom line, to keep customers happy.

If your interaction is with a major hardware vendor, don't automatically assume that the rep deserves to be scorned for saying "We have problems with Warp." Some hardware *does* have problems with Warp. Many companies are busy writing OS/2-specific drivers, though they may not be announced yet. Ask about the status of those drivers, when they will be ready, and ask for temporary workarounds.

The attitude you exhibit here matters. OS/2 users have earned a reputation of being hard to please, if not obnoxious. Be persistent, yet professional. If, at the end of the conversation, the technician remains unwilling to help you resolve a Warp problem, sigh audibly and let him know – more in sorrow than in anger – that his company's unresponsiveness to your computing needs will affect your future purchasing decisions. Nothing speaks quite as loudly as your checkbook.

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Often, more excellent technical articles are submitted than can fit into *IBM Personal Software Magazine*. Rather than let these fine articles go unpublished, they are now compiled into a supplemental "magazine" which is available to readers on the Internet. The supplemental articles, as well as instructions for downloading them, can be found on the World Wide Web at the following URL:

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The URL site also contains the articles in this issue of *IBM Personal Software Magazine*, so that everyone may have a personal copy of this information. Send your suggestions and comments, both positive and negative, to GBARLOW@VNET.IBM.COM.

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